THE RESOURCES AGENCY OF CALIFORNIA

Department of Water Resources

BULLETIN No. 65-61

QUALITY OF SURFACE WATERS IN CALIFORNIA

1960-1961

VOLUME I

NORTHERN AND CENTRAL CALIFORNIA

Part 1: Text

AUGUST 1963

HUGO FISHER
Administrator
The Resources Agency of California

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources

State of California

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ERRATA

Bulletin No. 65-61, "Quality of Surface Waters in California, 1960-1961," Volume I, Northern and Central California, Part 1: Text

Page 287. The ordinates for the Water Quality Variations graphs are as follows:

Lower graph - Specific Conductance
(Micromhos at 25°C)

Upper graph - Chloride
(in parts per million)

FOREWORD

Bulletin No. 65-61 is the sixth in a series of reports on surface water quality conditions in California. Because this bulletin contains data for both 1960 and 1961, there is no Bulletin No. 65-60.

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THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
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JUNE 3, 1963

Honorable Edmund G. Brown, Governor,
and Members of the Legislature of
the State of California

State Water Pollution Control Board

Gentlemen:

I have the honor to transmit Bulletin No. 65-61 entitled "Quality of Surface Waters in California, 1960-1961, Volume I, Northern and Central California." This is the sixth in a continuing chronological series of reports on quality of surface waters in California. Surface waters in Northern and Central California are discussed in Volume I; Southern California surface water quality will be reported in Volume II.

At the request of the State Water Pollution Control Board, a statewide surface water monitoring program was commenced in April 1951. As authorized by Section 229 of the Water Code, the Department of Water Resources has administered this program in cooperation with the State Department of Public Health, Bureau of Sanitary Engineering; the State Department of Fish and Game; the United States Geological Survey; and various other agencies and individuals. Under the statewide program, samples from 212 stations, located on 144 different water sources, are collected and analyzed monthly to maintain surveillance on quality of surface waters in California. This volume reports the results of monitoring at 180 of these stations, located on 111 streams and lakes, in Northern and Central California.

During 1960 and 1961, surface waters of Northern and Central California experienced a considerable seasonal deterioration in quality. This was due primarily to the drought conditions prevailing throughout the 1960-61 period. Fortunately, this deterioration in quality was insufficient in magnitude to be of concern at the majority of stations where surface water quality is monitored. However, there were some streams in which quality degradation was significant. Of most concern was the quality of water in the lower reaches of the San Joaquin River and certain channels of the Sacramento-San Joaquin Delta where, from the standpoint of irrigation use, the quality was the poorest recorded. I should like to point out that the trend toward increased salts in these streams was halted in 1962 because of higher flows.

Honorable Edmund G. Brown, et al

Volume II of this bulletin, which will include an evaluation of surface water quality conditions in Southern California, will be published at a later date.

Sincerely yours,

William E. Warne

Director

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

EDMUND G. BROWN, Governor
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ACKNOWLEDGMENTS

The extensive coverage of the statewide surface water monitoring program is made possible through cooperation of federal, state, and local agencies. The helpful cooperation of the following agencies is gratefully acknowledged:

Federal Agencies

Department of the Army

Corps of Engineers

Department of the Interior

Bureau of Reclamation

Geological Survey

Department of Health, Education and Welfare

Public Health Service

State Agencies

California Disaster Office, Radiological Service

Department of Fish and Game

Department of Public Health

Bureau of Sanitary Engineering

Division of Laboratories

State Water Pollution Control Board

Other Public Agencies

City and County of San Francisco

Kern County Land Company

Kings River Water Association

The Department of Water Resources wishes to especially thank the following federal agencies who granted permission for inclusion in this report of unpublished water quality data collected under various programs:

United States Department of the Interior

Bureau of Reclamation

Geological Survey

In addition, the United States Geological Survey performed a substantial portion of the analyses required by this program under a cooperative agreement with the Department of Water Resources. The bacteriological determinations were made by the California State Department of Public Health and the radiological determinations by the California Disaster Office under provisions of an agreement with the State Water Pollution Control Board.

INTRODUCTION

A usable as well as abundant source of water is essential to the development of California. To insure that California's rapidly expanding economy and increasing population are provided with a usable supply of water, the early detection and control of quality impairment is necessary. Realizing the need for a surveillance program, the State of California began to systematically examine the quality of its surface waters in April 1951. Since that time, this monitoring program has been conducted by the Department of Water Resources in cooperation with numerous agencies and individuals.

This bulletin is the sixth in a series of reports on surface water quality conditions in California. Data presented were collected by the Department of Water Resources and other public agencies in California. In addition to basic data, this bulletin contains evaluations and interpretations of significant quality variations detected during 1960 and 1961 and, where possible, an explanation of the causes of these variations.

To disseminate quality data as soon as practicable, the department also publishes and distributes a monthly report containing data and a brief discussion of significant quality variations detected each month. These reports are distributed to pollution control, public health, and other agencies and individuals.

Volume I of this bulletin presents water quality data and an evaluation of surface water quality conditions in Water Pollution Control Regions 1 and 2, the portion of Region 3 north of the San Antonio-Salinas River drainage boundary, Region 5, and the portion of Region 6 north of the Mono Lake drainage divide. Volume II, to be published at a later date, will present data and an evaluation of surface water quality conditions in the southern portion of Water Pollution Control Region 3 (Santa Ynez, Santa Maria, Nacimiento, and San Antonio Rivers, and the portion of Salinas River upstream from the confluence of San Antonio

River), all of Region 4, Region 6 south of the northern Mono Lake drainage boundary, and all of Regions 7, 8, and 9. The regions and the areas reported on in this volume are shown on Plates 1 through 5.

The 1960 and 1961 stream sampling programs reported herein comprised the collection of water samples and analyses from 180 stations on 111 streams and lakes throughout Northern and Central California. Previous quality monitoring data are included in the following report and bulletins:

California Department of Public Works, Division of Water Resources, Water Quality Investigations. "Quality of Surface Waters in California, 1951-1954." Report No. 15.

California Department of Water Resources, Division of Resources Planning. "Quality of Surface Waters in California, 1955-1956." Bulletin No. 65.

----. "Quality of Surface Waters in California, 1957." Bulletin No. 65-57.

----. "Quality of Surface Waters in California, 1958." Bulletin No. 65-58.

----. "Quality of Surface Waters in California, 1959, Part I, Northern and Central California." Bulletin No. 65-59.

----. "Quality of Surface Waters in California, 1959, Part II, Southern California." Bulletin No. 65-59.

The activities of the department's surface water monitoring program are authorized by Section 229 of the Water Code, which directs that:

> "The department ... shall investigate conditions of the quality of all waters within the State, including saline waters, coastal and inland, as related to all sources of pollution of whatever nature and shall report thereon to the Legislature and to the appropriate regional water pollution control board annually, and may recommend any steps which might be taken to improve or protect the quality of such waters."

The basic objectives of the department's surface water quality monitoring program are:

(a) to secure continuous and reliable water quality data from a network of stations which will provide representative data pertaining to the quality of water in the major surface streams and lakes of the State;

(b) to evaluate information collected during the course of the program to develop a comprehensive understanding of the factors which make up and alter the water quality at any station; and

(c) to detect changes in water quality and to notify the appropriate control agency (regional water pollution control boards, state, and local health departments, State Department of Fish and Game) when warranted.

Part I of Volume I of this bulletin contains a discussion of the surface water quality data collected by the Department of Water Resources, and plates depicting the location of sampling points. Part II of Volume I contains a summary of field and laboratory procedures, the criteria used in evaluating the quality of water, and compilations of the physical, mineral, bacteriological, and radiological analyses made of samples collected during 1960 and 1961.

In Part I, discussion is presented in successive order, by water pollution control regions which are numbered and named substantially in accordance with the major surface drainage basins with which they are coterminous (see Frontispiece). For convenience in presentation, the Central Valley Region (No. 5) has been divided into four separate areas, 5a, 5b, 5c, and 5d. Area 5a embraces the Sacramento Valley, 5b the San Joaquin Valley, 5c the Sacramento-San Joaquin Delta, and 5d the Tulare Lake Basin. Within each region, the discussion is presented by basins or stream groups. In each basin or stream group, the main stream is discussed first, followed by a discussion and summary of data, in downstream order, of all monitoring stations. The discussion for each monitoring

station includes a detailed description of the location of the sampling point, period of record, principal water quality characteristics, and a summary of significant water quality changes in 1960 and 1961. For each station, the maximum and minimum concentrations of the mineral constituents in the water for the total period of record and for 1961 are listed, and graphs depicting the monthly variation for the period of record of streamflow, specific conductance, and, where applicable, concentrations of significant constituents are presented.

Following the presentation of the Department of Water Resources program, a listing of water quality monitoring stations maintained by other agencies during 1960 and 1961 is also presented. This listing includes the name of the station, a description of the sampling point, the agency responsible for the station operation, and the period of record. No attempt is made in this bulletin to present an evaluation of quality data collected by other agencies.

Results of bacteriological and radiological determinations presented in this bulletin should be considered as only qualitative indicators and undue weight should not be given to quantitative values. The indicators contribute to long-term environmental studies.

Bacteriological determinations are expressed as the most probable number (MPN) of coliform bacteria per milliliter (ml) of sample. In view of the rapidity and frequency of change in the density of coliform organisms, frequent and lengthy sampling is necessary before a truly reliable evaluation can be made.

Radiological determinations are expressed in terms of activity, measured in micro-micro curies per liter (uuc/l). Even though evaluation criteria have been recommended by the United States Public Health Service and other agencies, no attempt has been made to evaluate the specific effects on domestic water supplies of the radioactive concentrations found.

QUALITY OF SURFACE WATERS IN NORTHERN AND CENTRAL CALIFORNIA
DURING 1960 AND 1961

SUMMARY

The years 1960 and 1961 were the second and third in a period of drought. As a result, streamflow was correspondingly reduced and, in some areas of the State, quite drastically. Accordingly, in the absence of normal supplies of diluting water, minerals in solution became more concentrated in many streams, and in some waters, degradation resulting from the development and utilization of water supplies or from natural causes began to dominate their qualities continually.

Fortunately, this deterioration of the quality of surface waters in the northern and central parts of the State was of small significance at many stations for, while mineral concentrations at these stations were higher than that previously recorded, the minerals were not present in concentrations which would affect any beneficial use. However, there were some streams and stream systems which suffered significant degradation of the quality of their waters. Principal among these were the lower reaches of the San Joaquin River and certain channels of the Sacramento-San Joaquin Delta. From the standpoint of irrigation in particular, waters at specific stations on the San Joaquin River and in the Delta had attained the poorest quality ever known.

North Coastal Region (No. 1)

The North Coastal Region extends southward from the Oregon border 270 miles, to the northern boundary of Lagunitas Creek Basin in Marin County, and ranges in width from 180 miles at the Oregon boundary to 30 miles in the southern portion.

Terrain of this region is largely mountainous, with cliffs often several hundred feet high along the coastline, and steep canyons and numerous ridges with many peaks inland. Valley and mesa land, easily adaptable to agricultural development, comprises about 15 percent of the 19,586 square miles in this region. A fairly thick absorptive soil mantle covers much of the area and helps sustain streamflow through drier portions of the year.

Natural mean seasonal surface runoff is estimated to exceed 28,800,000 acre-feet. Principal hydrographic units in this region include the drainage basins of the Smith, Klamath, Mad, Eel, and Russian Rivers. Thirty-two sampling stations shown on Plate 1, "Surface Water Monitoring Program Stream Sampling Stations North Coastal Region (No. 1)," are being monitored to obtain information and to provide a continuing check on the quality of surface water resources in the North Coastal Region. Monitored streams are listed below with the number of sampling stations along each in parentheses.

Klamath River (5)
Antelope Creek (1)
Butte Creek (1)
Shasta River (1)
Scott River (1)
Salmon River (1)
Trinity River (3)
Smith River (1)
Redwood Creek (1)
Mad River (1)
Eel River (3)
Outlet Creek (1)
Eel River, Middle Fork (1)
Eel River, South Fork (1)
Van Duzen River (1)
Mattole River (1)
Noyo River (1)
Big River (1)
Navarro River (1)
Gualala River (1)
Russian River (3)
Russian River, East Fork (1)

A review of quality data revealed surface water in the northern portion of this region to be predominantly calcium-magnesium bicarbonate, while streams in the remaining portions were generally calcium bicarbonate in character. Excellent quality water for all but the most exacting requirements is found in North Coastal streams. During 1960 and 1961 there was no appreciable change in the mineral quality of streams in the North Coastal Region.

Klamath River Basin

The California portion of the Klamath River Basin is located in the northern section and comprises over one-half the North Coastal area. The watershed includes all tributaries downstream from the boundary between Oregon and California as well as those portions of Butte Valley (a basin of interior drainage), Lost River and Tule Lake Basins that lie in California. The Klamath's main tributaries in California are Trinity, Salmon, Scott, Shasta, and Lost Rivers. The Klamath River Basin encompasses 15,715 square miles of which approximately 10,020 square miles are in California. The average seasonal flow of the Klamath River into the Pacific Ocean is about 12,500,000 acre-feet.

Land classification surveys indicate approximately 405,000 acres of land in this basin are irrigable of which 182,000 acres are presently irrigated. The approximately 6,000,000 remaining acres are comprised of a series of mountain ranges separated by long, narrow river valleys. The mountainous areas and undeveloped valley lands are used extensively for livestock range, timber production, mining. and recreation. Support of fish and wildlife is of major importance to the welfare of this basin.

Numerous lumbermill operations and small communities discharge waste into the Klamath River. Most of these wastes are minor in quantity and do not result in a discernible quality impairment problem. Irrigation return causes some mineral impairment of tributaries to Klamath River; however, the overall effect is not significant.

Thirteen surface water monitoring stations are located in the Klamath River Basin. The following tabulation presents the names of stations maintained to monitor quality of surface water in this basin and the page on which each is discussed.

KLAMATH RIVER NEAR COPCO (STA. 1)

Sampling Point. The monitoring station is located in Section 36 of Township 48 North, Range 5 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the USGS gage, 1 mile downstream from Copco No. 2 powerplant of the California-Oregon Power Company, 500 feet downstream from Fall Creek.

Period of Record. April 1951 through November 1961.

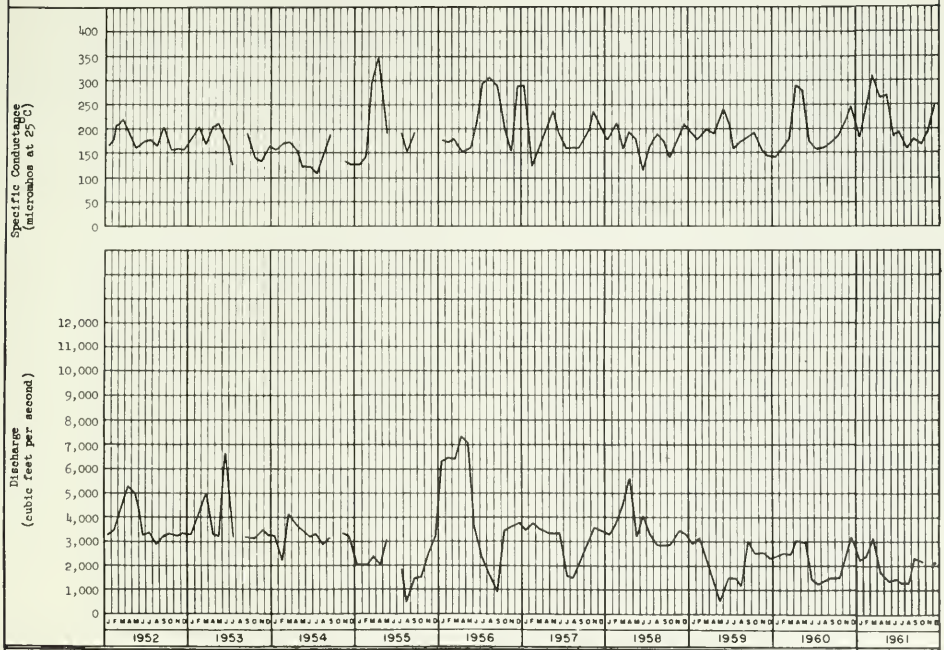
Water Quality Characteristics. Klamath River near Copco is excellent, a bicarbonate type with sodium as its most predominant cation, class 1 for irrigation, soft to slightly hard, and meets drinking water standards for mineral content.

Significant Water Quality Changes. The collection of samples at this station was discontinued after November 1961 due to the completion of Iron Gate Dam. A new station was established at a point below Iron Gate Dam approximately seven miles downstream from Station 1 in December 1961.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	353	121	308	158
Temperature in °F	74	35	72	38
Diseolved oxygen in parts per million	11.4	4.7	11.4	5.9
Percent saturation	113	49	94	57
pH	8.2	6.4	7.6	6.9
Mineral constituents in parts per million				
Calcium (Ca)	25	5.1	16	14
Magnesium (Mg)	13	3.6	9.8	5.1
Sodium (Na)	29	6.9	25	13
Potassium (K)	4.6	1.3	3.0	2.9
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	112	54	110	75
Sulfate (SO_4)	58	6.0	58	12
Chloride (Cl)	10	0.0	10	1.2
Nitrate (NO_3)	5.4	1.1	2.3	1.1
Fluoride (F)	0.6	0.0	0.2	0.1
Boron (B)	0.30	0.0	0.3	0.0
Silica (SiO_2)	43	5.3	38	23
Total dissolved solids in parts per million	250	84	220	113
Percent sodium	55	19	46	31
Hardness as $CaCO_3$ in parts per million				
Total	115	38	100	52
Noncarbonate	28	0.0	11	0.0
Turbidity	50	0.0	20	1
Coliform in most probable number per milliliter	7,000. +	0.06	2,400.	0.45 -
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.90	0.00	0.09	0.07
Solid alpha	0.52	0.00	0.07	0.0
Dissolved beta	22.9	0.00	14.0	6.3
Solid beta	12.4	0.00	12.4	0.0

WATER QUALITY VARIATIONS



KLAMATH RIVER NEAR COPCO (STA. NO. 1)

KLAMATH RIVER ABOVE HAMBURG RESERVOIR SITE (STA. 1c)

Sampling Point. Klamath River monitoring Station 1c is located in Section 14 of Township 46 North, Range 10 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from a bridge on State Highway 96, in the center of the channel of flow, about six miles upstream from the mouth of Scott River, about seven miles northeast of the town of Hamburg.

Period of Record. December 1958 through December 1961.

Water Quality Characteristics. Mineral classification of analyses of samples from this station show the water to be a bicarbonate type with no major cation. Qualitatively, this river is class 1 for irrigation, slightly hard to moderately hard, and meets drinking water standards for mineral content. The concentration of most mineral constituents in Klamath River between Station 1 near Copco and Station 1c are fairly comparable. Based upon limited data, it appears that the Shasta River at times may slightly degrade water quality of the Klamath in the reach immediately above Station 1c.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	295	166	295	176
Temperature in °F	80	34	80	39
Diseolved oxygen in parts per million	13.7	7.4	11.5	7.4
Percent saturation	131	82	103	83
pH	8.3	7.3	8.3	7.3
Mineral constituents in parts per million				
Calcium (Ca)	19	5.2	18	5.2
Magnesium (Mg)	11	6.6	11	11
Sodium (Na)	26	4.0	26	4.0
Potassium (K)	4.9	1.6	3.2	2.6
Carbonate (CO_3)	2	0.0	0.0	0.0
Bicarbonate (HCO_3)	128	85	128	90
Sulfate (SO_4)	45	5.0	38	10
Chloride (Cl)	12	3.2	10	3.2
Nitrate (NO_3)	3.0	0.0	1.5	1.5
Fluoride (F)	0.2	0.0	0.2	0.1
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	42	19	38	24
Total dissolved solids in parts per million	204	114	204	121
Percent sodium	39	9	39	9
Hardness as $CaCO_3$ in parte per million				
Total	107	55	103	55
Noncerbonate	16	0.0	8	0.0
Turbidity	140	1	40	3
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.26	0.00	0.25	0.0
Solid alpha	0.27	0.00	0.25	0.0
Dissolved beta	8.95	3.14	5.7	3.8
Solid beta	7.1	0.00	7.1	2.8

WATER QUALITY VARIATIONS

KLAMATH RIVER ABOVE HAMBURG RESERVOIR SITE (STA. NO. 1c)

KLAMATH RIVER NEAR SEIAD VALLEY (STA. 2b)

Sampling Point. Station 2b is located in Section 3 of Township 46 North, Range 12 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at mid-depth, from the right bank, at the USGS gaging station, 0.4 mile upstream from Bittenbender Creek, about 14 miles downstream from the mouth of Scott River, and 2.2 miles west of the town of Seiad Valley.

Period of Record. December 1958 through December 1961.

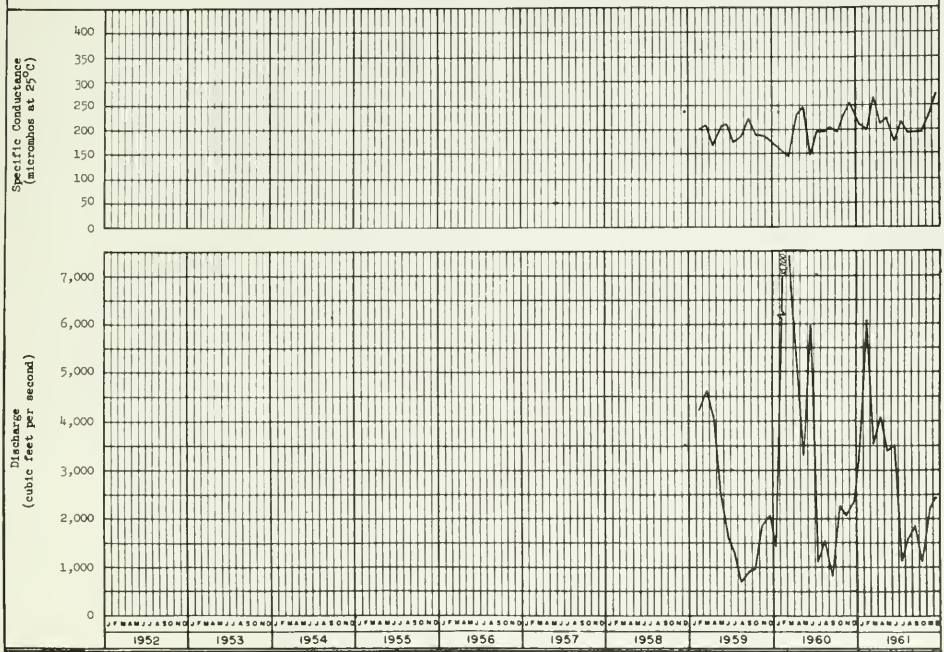
Water Quality Characteristics. Since inception of monitoring of the Klamath River at this station, the water has been excellent in quality, calcium-magnesium bicarbonate in character, class 1 for irrigation, slightly hard, and has met drinking water standards for mineral content. There is normally no significant difference between the mineral content of the Klamath River at this station and above Hamburg Reservoir Site (Station 1c). However, it is noted that during periods of high inflow from the Scott River, the major tributary to the Klamath River between Stations 1c and 2b, regardless of flow conditions on the Klamath, a significant decrease in the mineral content of the Klamath River occurs. This condition was shown by conductivity values in March 1960, which decreased from approximately 220 micromhos at Station 1c to approximately 147 micromhos at Station 2b. This phenomenon indicates mineral content of Scott River is sufficiently low to more than offset the degradation of Klamath River caused by Shasta River.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	272	147	272	171
Temperature in °F	79	35	79	38
Dissolved oxygen in parts per million	13.7	7.8	12.2	7.8
Percent saturation	114	87	104	87
pH	8.3	7.3	8.3	7.3
Mineral constituents in parts per million				
Calcium (Ca)	19	12	17	15
Magnesium (Mg)	12	6.1	9.6	8.1
Sodium (Na)	23	6.0	23	9.6
Potassium (K)	4.1	1.2	2.4	1.7
Carbonate (CO_3)	4	0.0	0.0	0.0
Bicarbonate (HCO_3)	122	74	122	89
Sulfate (SO_4)	36	6.0	24	10
Chloride (Cl)	10.0	2.0	8.7	3.0
Nitrate (NO_3)	2.6	0.0	1.7	0.7
Fluoride (F)	0.3	0.0	0.3	0.1
Boron (B)	0.3	0.0	0.2	0.0
Silica (SiO_2)	40	17	37	20
Total dissolved solids in parts per million	190	100	190	120
Percent sodium	38	17	36	19
Hardness as $CaCO_3$ in parts per million				
Total	101	58	101	64
Noncarbonate	10	0.0	6.0	0.0
Turbidity	155	1	60	2
Coliform in most probable number per milliliter	(Not Measured)			
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.22	0.0	0.22	0.0
Solid alpha	0.56	0.07	0.08	0.07
Dissolved beta	15.61	0.00	5.4	0.3
Solid beta	19.08	0.00	5.7	0.94

WATER QUALITY VARIATIONS



KLAMATH RIVER NEAR SEIAD VALLEY (STA. NO. 2b)

KLAMATH RIVER AT SOMESBAR (STA. 2)

Sampling Point. The Somesbar station is located on the Klamath River in Section 4 of Township 11 North, Range 6 East, Humboldt Base and Meridian. Monthly grab samples were collected at mid-depth, from the left bank, 300 feet downstream from the USGS gage, 1 mile west of Somesbar post office, and 500 feet downstream from Salmon River.

Period of Record. April 1951 through December 1961.

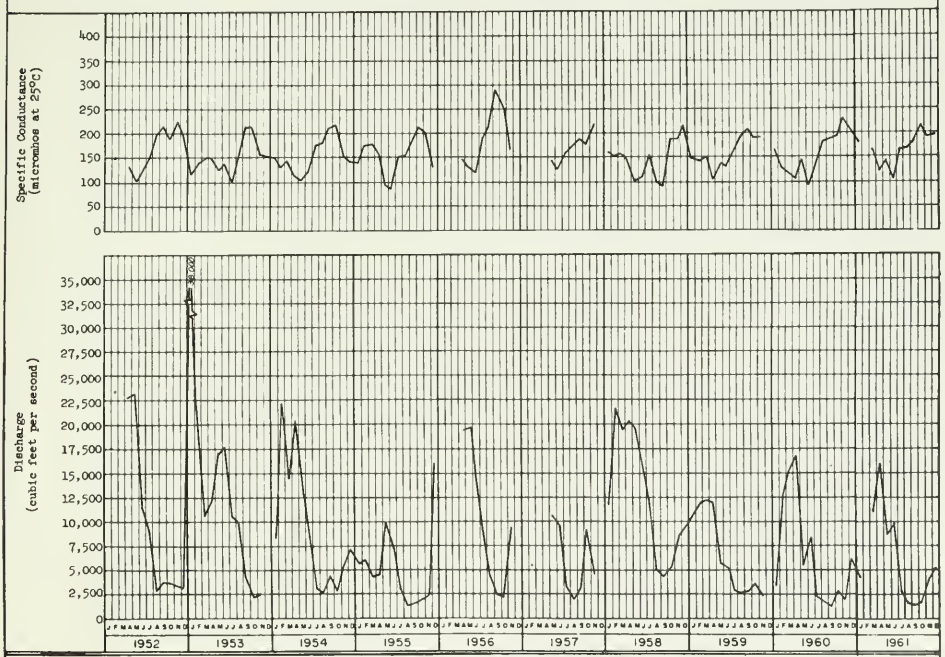
Water Quality Characteristics. Flow in Klamath River at Station 2 is excellent in quality, calcium-magnesium bicarbonate in character, class 1 for irrigation, with a range from soft to slightly hard, and meets drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	289	89.8	213	106
Temperature in °F	81	38	76	44
Dissolved oxygen in parts per million	14.2	7.2	12.2	8.4
Percent saturation	124	59	106	90
pH	8.8	6.3	8.3	7.5
Mineral constituents in parts per million				
Calcium (Ca)	23	9.2	16	12
Magnesium (Mg)	11	2.6	8.3	6.8
Sodium (Na)	22	1.6	14	1.6
Potassium (K)	3.4	0.7	1.6	1.1
Carbonate (CO_3)	2	0.0	1	0.0
Bicarbonate (HCO_3)	124	40	115	56
Sulfate (SO_4)	35	3.5	9.6	8.0
Chloride (Cl)	9.0	0.0	7.0	1.2
Nitrate (NO_3)	2.4	0.0	0.2	0.2
Fluoride (F)	0.4	0.0	0.1	0.0
Boron (B)	0.3	0.0	0.2	0.0
Silica (SiO_2)	36	5.3	21	18
Total dissolved solids in parts per million	196	57	144	72
Percent sodium	34	6	32	7
Hardness as $CaCO_3$ in parts per million				
Total	98	38	79	46
Noncarbonate	20	0.0	9	0.0
Turbidity	100	0.0	* 15	1
Coliform in most probable number per milliliter	2,400.	0.045	230.	0.06
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.33	0.08	0.16	0.08
Solid alpha	0.72	0.00	0.16	0.08
Dissolved beta	13.30	0.00	6.4	4.0
Solid beta	22.5	0.00	1.0	0.2

WATER QUALITY VARIATIONS



KLAMATH RIVER AT SOMESBAR (STA. NO. 2)

KLAMATH RIVER NEAR KLAMATH (STA. 3)

Sampling Point. Station 3 is located in Section 17 of Township 13 North, Range 2 East, Humboldt Base and Meridian. Monthly grab samples were collected at mid-depth from the right bank, about 1 mile downstream from the USGS gaging station, 3.3 miles east of Klamath, and 0.4 mile upstream from Klamath Glen Road.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Klamath River water at this station is excellent in quality, calcium-magnesium bicarbonate in character, and class 1 for irrigation. It consistently ranges from soft to slightly hard, and meets drinking water standards for mineral content.

Significant Water Quality Changes. None

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	280	47.1	193	106
Temperature in °F	74	40	71	45
Dissolved oxygen in parts per million	14.0	7.4	11.5	7.9
Percent saturation	121	81	121	87
pH	8.3	5.7	8.3	7.3
Mineral constituents in parts per million				
Calcium (Ca)	21	4.0	17	12
Magnesium (Mg)	10	1.9	7.5	6.3
Sodium (Na)	13	1.4	11	1.4
Potassium (K)	3.0	0.4	1.4	0.7
Carbonate (CO_3)	2	0.0	2	0.0
Bicarbonate (HCO_3)	130	18	98	57
Sulfate (SO_4)	29	1.0	7.6	5.0
Chloride (Cl)	16	0.0	7.3	0.9
Nitrate (NO_3)	1.5	0.0	0.0	0.0
Fluoride (F)	0.3	0.0	0.1	0.0
Boron (B)	0.54	0.0	0.1	0.0
Silica (SiO_2)	29	5.7	20	14
Total dissolved solids in parts per million	182	30	125	69
Percent sodium	32	5	26	5
Hardness as $CaCO_3$ in parts per million				
Total	94	18	76	48
Noncarbonate	8	0.0	7	0.0
Turbidity	300	0.0	30	1
Coliform in most probable number per milliliter	7,000. +	0.045 -	620.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.24	0.00	0.23	0.15
Solid alpha	1.43	0.00	0.07	0.0
Dissolved beta	16.00	0.00	8.9	0.0
Solid beta	16.86	0.00	2.3	0.0

WATER QUALITY VARIATIONS

KLAMATH RIVER NEAR KLAMATH (STA. NO. 3)

ANTELOPE CREEK NEAR TENNANT (STA. 1e)

Sampling Point. The station is located in Section 25 of Township 43 North, Range 1 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank. The sampling point is 4 miles downstream from Frog Lake, 17 miles southeast of the town of Mount Hebron, and 2.5 miles south of Tennant.

Period of Record. March 1959 through December 1961.

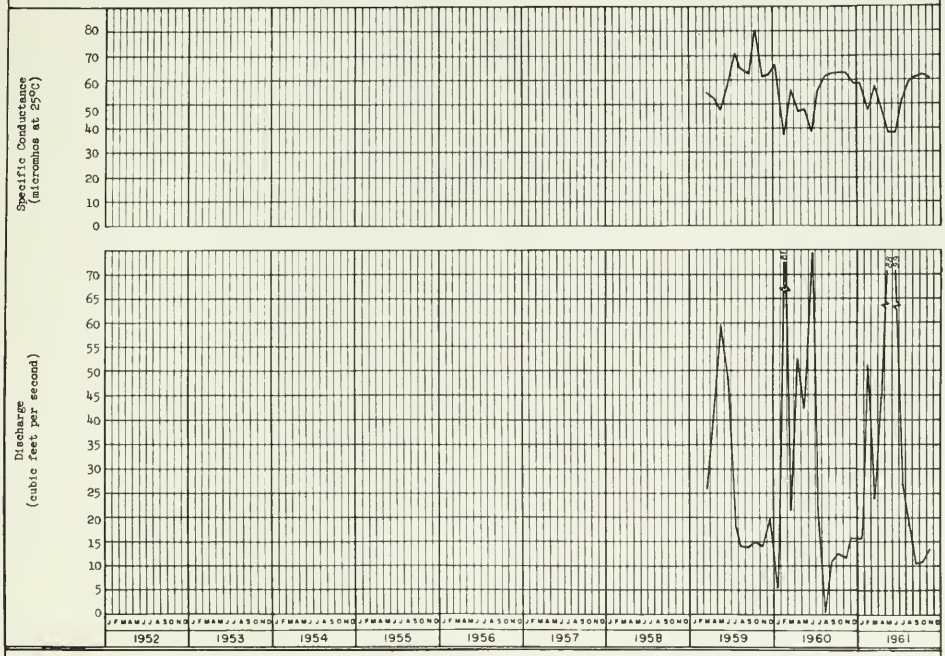
Water Quality Characteristics. Analyses of samples of Antelope Creek show it to be calcium-bicarbonate in character, class 1 for irrigation, soft, and meets drinking water standards for mineral content.

Significant Water Quality Changes. None

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	79.4	38.0	62.0	38.0
Temperature in °F	60	32	55	33
Dissolved oxygen in parts per million	12.4	7.7	11.8	8.9
Percent saturation	97	73	96	80
pH	7.9	7.0	7.9	7.1
Mineral constituents in parts per million				
Calcium (Ca)	8.8	2.4	7.2	3.8
Magnesium (Mg)	3.9	1.3	1.6	1.3
Sodium (Na)	5.9	1.0	4.1	1.4
Potassium (K)	2.6	0.3	1.4	0.8
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	47	19	38	21
Sulfate (SO_4)	2.0	0.0	0.8	0.0
Chloride (Cl)	6.0	0.0	1.5	0.0
Nitrate (NO_3)	1.5	0.0	0.2	0.0
Fluoride (F)	0.3	0.0	0.1	0.1
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	37	19	30	19
Total dissolved solids in parts per million	88	38	71	39
Percent sodium	30	10	30	10
Hardness as $CaCO_3$ in parts per million				
Total	36	14	26	16
Noncarbonate	7	0.0	4	0.0
Turbidity	30	1	5	1
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.41	0.0	0.16	0.0
Solid alpha	0.54	0.00	0.16	0.08
Dissolved beta	3.36	0.00	1.4	0.7
Solid beta	13.16	0.00	11.9	2.2

WATER QUALITY VARIATIONS



ANTELOPE CREEK NEAR TENNANT (STA. NO. 1e)

BUTTE CREEK NEAR MACDOEL (STA. 1d)

Sampling Point. Station 1d is located in Section 30 of Township 45 North, Range 1 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, 7.5 miles downstream from Little Antelope Creek and 7 miles south of Macdoel.

Period of Record. March 1959 through December 1961.

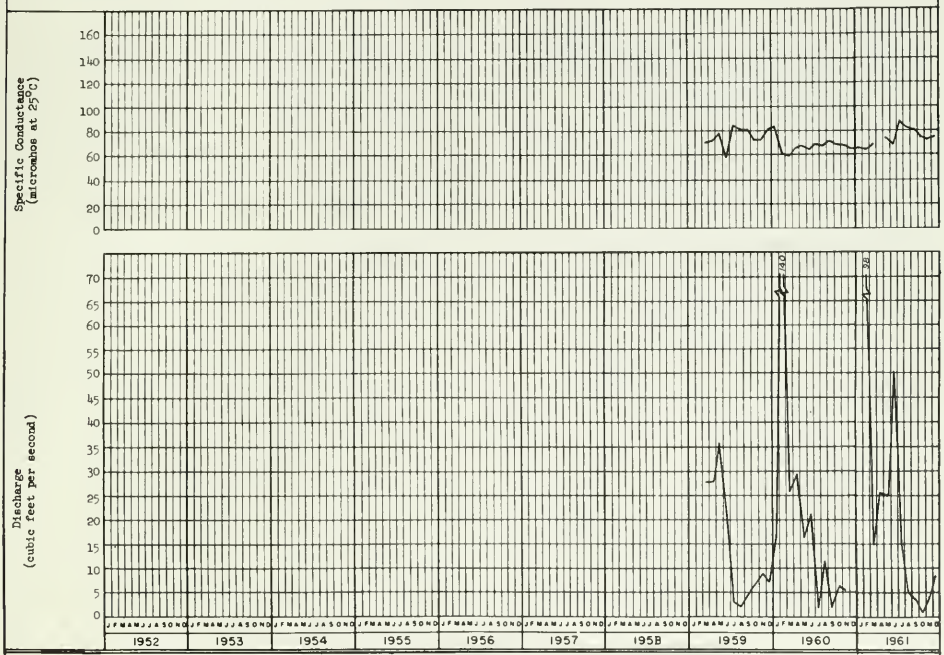
Water Quality Characteristics. Butte Creek water is a bicarbonate type with calcium and magnesium as major cations. This water is excellent in quality, class 1 for irrigation, soft, and has a mineral content within the limits for drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	89	56.9	89	64
Temperature in °F	70	32	69	32
Dissolved oxygen in parts per million	12.3	7.3	11.9	7.4
Percent saturation	108	73	108	77
pH	8.1	6.9	8.1	7.0
Mineral constituents in parts per million				
Calcium (Ca)	10	4.8	8.0	7.1
Magnesium (Mg)	4.9	1.8	3.2	2.9
Sodium (Na)	5.5	1.4	5.5	1.4
Potassium (K)	2.9	1.3	1.7	1.3
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	53	30	53	38
Sulfate (SO_4)	9.6	0.0	1.0	0.0
Chloride (Cl)	6.0	0.0	1.5	0.0
Nitrate (NO_3)	1.1	0.0	0.3	0.2
Fluoride (F)	0.4	0.0	0.2	0.1
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	38	17	29	21
Total dissolved solids in parts per million	87	57	86	62
Percent sodium	29	9	29	9
Hardness as $CaCO_3$ in parts per million				
Total	37	20	37	26
Noncarbonate	2	0.0	0.0	0.0
Turbidity	50	1	20	1
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.72	0.00	0.41	0.0
Solid alpha	0.45	0.00	0.0	0.00
Dissolved beta	6.18	0.00	3.2	0.0
Solid beta	13.16	0.00	4.5	4.1

WATER QUALITY VARIATIONS



BUTTE CREEK NEAR MACDOEL (STA. NO. 1d)

SHASTA RIVER NEAR YREKA (STA. 1a)

Sampling Point. Station 1a is located in Section 24 of Township 46 North, Range 7 West, Mt. Diablo Base and Meridian. Monthly water samples were collected from the right bank, 0.5 mile upstream from the mouth of the Shasta River, and 7 miles north of Yreka.

Period of Record. December 1958 through December 1961.

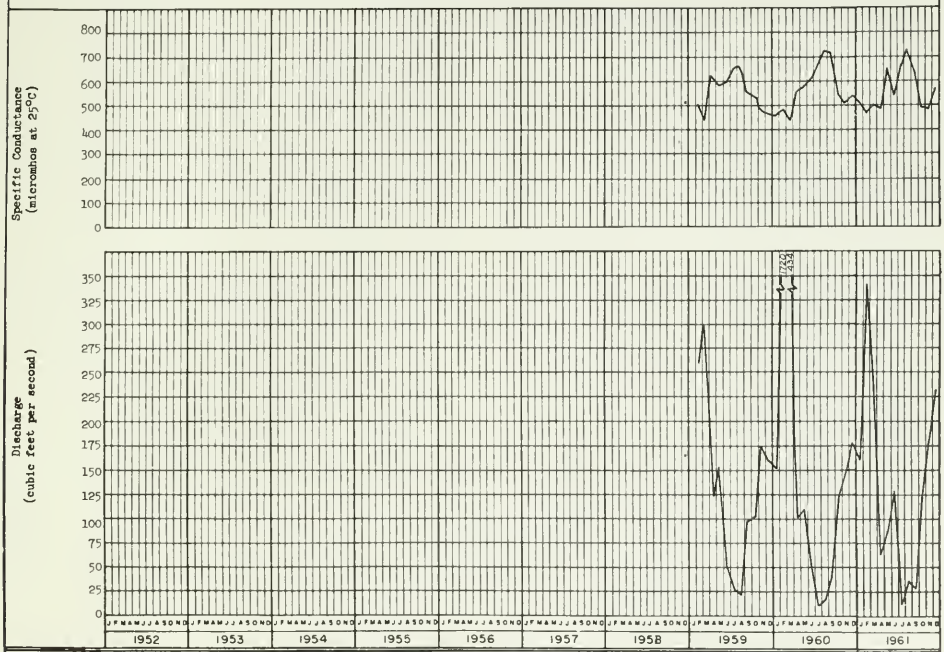
Water Quality Characteristics. Since inception of a monitoring station on this river concentrations of mineral constituents, with the exception of boron, have been within the acceptable limits for nearly all beneficial uses. Samples of water taken were of the magnesium bicarbonate type, moderate to very hard. Boron is frequently found in excess of 0.5 ppm, the upper limit for a class 1 irrigation water.

Significant Water Quality Changes. During seven months of 1960 and six months of 1961, boron exceeded 0.5 ppm in Shasta River. The concentration of boron is related to the magnitude of the discharge with the higher concentrations occurring at the low flows. The source of boron in this river is believed to be irrigation return and mineralized spring waters.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	734	423	734	482
Temperature in °F	85	32	85	43
Diseolved oxygen in parts per million	13.8	6.9	11.6	7.5
Percent saturation	114	76	105	81
pH	9.0	7.7	9.0	7.7
Mineral constituents in parts per million				
Calcium (Ca)	42	24	42	38
Magnesium (Mg)	43	28	43	39
Sodium (Na)	63	28	58	31
Potassium (K)	7.4	2.1	4.5	3.3
Carbonate (CO_3)	42	0.0	33	7
Bicarbonate (HCO_3)	408	222	408	238
Sulfate (SO_4)	23	4.8	11	9
Chloride (Cl)	45	14	40	18
Nitrate (NO_3)	2.0	0.0	0.8	0.2
Fluoride (F)	0.4	0.1	0.3	0.2
Boron (B)	0.9	0.4	0.7	0.4
Silice (SiO_2)	62	45	55	46
Total dissolved solids in parts per million	495	284	495	325
Percent sodium	35	24	35	24
Hardness as $CaCO_3$ in parts per million				
Total	295	118	295	190
Noncarbonate	0.0	0.0	0.0	0.0
Turbidity	300	1	15	1
Coliform in most probable number per milliliter	7,000. +	0.13	230.	0.13
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.30	0.00	0.15	0.0
Solid alpha	0.45	0.0	0.07	0.0
Dissolved beta	14.07	0.00	10.6	5.2
Solid beta	15.6	0.00	15.6	2.0

WATER QUALITY VARIATIONS



SHASTA RIVER NEAR YREKA (STA. NO. 1a)

SCOTT RIVER NEAR FORT JONES (STA. 1b)

Sampling Point. Scott River sampling station is located in Section 28 of Township 44 North, Range 10 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at mid-depth, from the right bank, 150 feet south of the Fort Jones-Scotts Bar road, about 20 miles upstream from the mouth, and 10.5 miles downstream from Fort Jones.

Period of Record. December 1958 through December 1961.

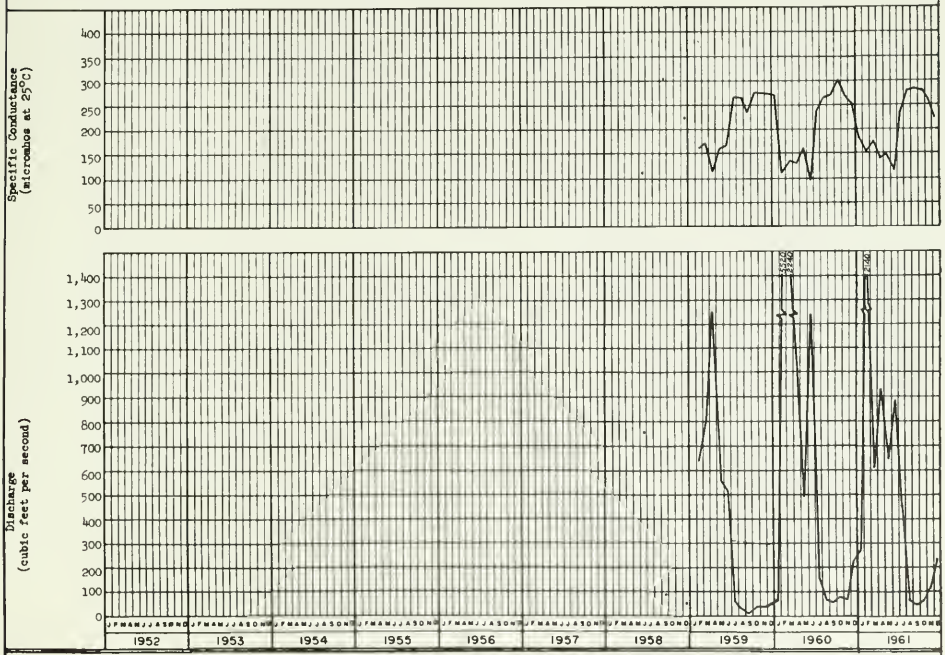
Water Quality Characteristics. A review of analyses reveals Scott River to be excellent in quality, class 1 for irrigation, bicarbonate in character with magnesium and calcium the major cations. It ranges from slightly moderately hard, and does not exceed the drinking water standard for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	304	99.1	288	118
Temperature in °F	77	33	67	44
Dissolved oxygen in parts per million	13.2	7.4	11.2	7.4
Percent saturation	126	76	110	76
pH	8.6	7.1	8.6	7.3
Mineral constituents in parts per million				
Calcium (Ca)	35	10	35	14
Magnesium (Mg)	17	6.9	15	9.6
Sodium (Na)	6.0	1.5	4.9	2.1
Potassium (K)	2.2	0.1	0.9	0.7
Carbonate (CO_3)	8	0.0	8	0.0
Bicarbonate (HCO_3)	179	52	174	71
Sulfate (SO_4)	10	0.6	5.0	1.0
Chloride (Cl)	9.0	0.4	6.0	0.6
Nitrate (NO_3)	3.2	0.3	2.1	0.9
Fluoride (F)	0.1	0.0	0.1	0.0
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	22	14	20	19
Total dissolved solids in parts per million	192	63	178	75
Percent sodium	9	5	8	6
Hardness as $CaCO_3$ in parts per million				
Total	150	46	149	62
Noncarbonate	10	0.0	5	0.0
Turbidity	125	1	40	1
Coliform in most probable number per milliliter	620.	0.06	23.	0.06
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.90	0.00	0.0	0.00
Solid alpha	0.45	0.00	0.08	0.0
Dissolved beta	6.31	0.00	6.2	4.8
Solid beta	18.0	0.00	18.0	10.2

WATER QUALITY VARIATIONS



SCOTT RIVER NEAR FORT JONES (STA. NO. 1b)

SALMON RIVER AT SOMESBAR (STA. 2a)

Sampling Point. Station 2a is located in Section 2 of Township 11 North, Range 6 East, Humboldt Base and Meridian. Monthly water samples were collected at mid-depth, from the right bank, 0.5 mile east of Somesbar post office, and 3 miles upstream from the confluence with the Klamath River.

Period of Record. November 1958 through December 1961.

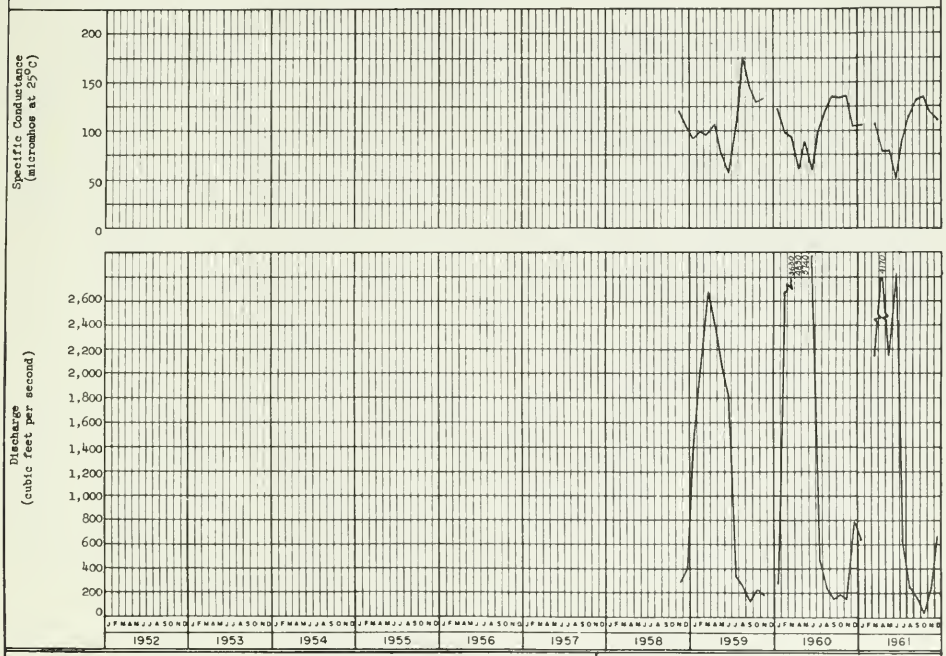
Water Quality Characteristics. Antecedent data classify flow in Salmon River as excellent in quality, calcium bicarbonate in character, soft to slightly hard, class 1 for irrigation, and well within drinking water standards for mineral content.

Significant Water Quality Changes. None

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	176	51	135	51
Temperature in °F	75	38	70	43
Dissolved oxygen in parts per million	13.1	8.3	12.0	9.6
Percent saturation	108	78	107	97
pH	8.6	7.3	8.6	7.3
Mineral constituents in parts per million				
Calcium (Ca)	20	10	18	11
Magnesium (Mg)	6.8	0.6	3.6	1.9
Sodium (Na)	10	0.4	3.6	0.7
Potassium (K)	1.8	0.1	1.0	0.5
Carbonate (CO_3)	3	0.0	3	0.0
Bicarbonate (HCO_3)	92	28	73	28
Sulfate (SO_4)	13	0.0	4.4	1.8
Chloride (Cl)	6.5	0.1	4.8	0.1
Nitrate (NO_3)	1.6	0.0	0.0	0.0
Fluoride (F)	0.3	0.0	0.1	0.0
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	18	9.5	16	13
Total dissolved solids in parts per million	109	35	94	35
Percent sodium	24	3	14	4
Hardness as $CaCO_3$ in parts per million				
Total	68	24	62	24
Noncarbonate	11	0.0	3	0.0
Turbidity	35	0.8	4	0.8
Coliform in most probable number per milliliter	2,400.	0.045-	6.2	0.045-
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.25	0.00	0.0	0.00
Solid alpha	0.33	0.00	0.24	0.0
Dissolved beta	4.1	0.00	4.1	3.6
Solid beta	17.67	0.00	9.3	5.6

WATER QUALITY VARIATIONS



SALMON RIVER AT SOMESBAR (STA. NO. 2a)

TRINITY RIVER AT LEWISTON (STA. 4a)

Sampling Point. Station 4a is located in Section 19 of Township 33 North, Range 8 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at mid-depth, from the left bank, at the USGS gaging station at Lewiston, and 0.8 mile downstream from Deadwood Creek.

Period of Record. April 1951 through December 1961.

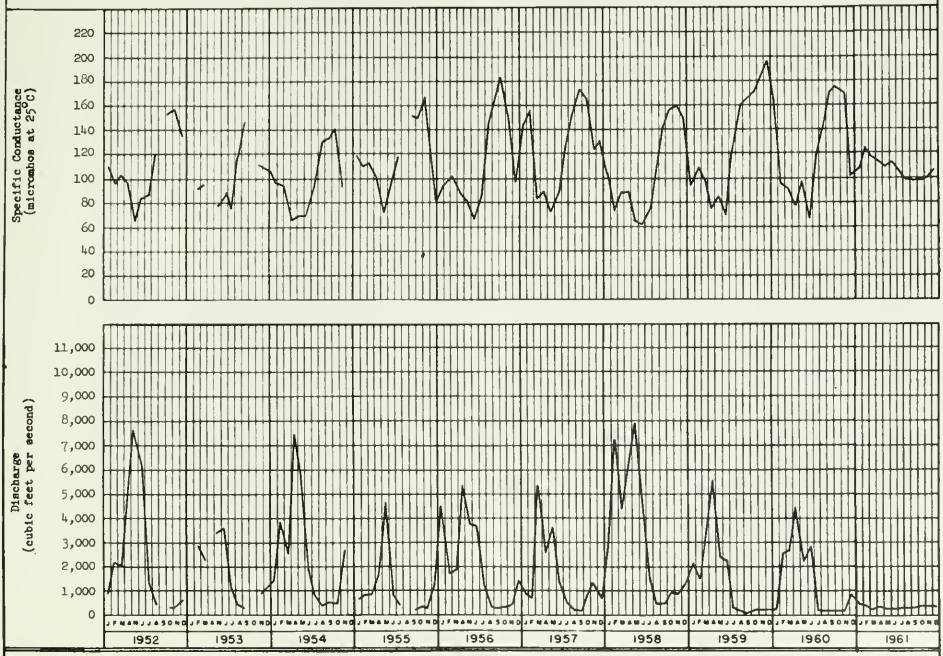
Water Quality Characteristics. Historical records at this station show the water is excellent in quality, generally magnesium bicarbonate in character, class 1 for irrigation, and within drinking water standards for mineral content.

Significant Water Quality Changes. Trinity Dam operation resulted in smaller fluctuations in streamflow and specific conductance in 1961 than in previous years.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	198	62.9	123	99
Temperature in °F	78	36	64	44
Dissolved oxygen in parts per million	14.2	5.9	12.1	10.0
Percent saturation	128	60	104	91
pH	8.2	6.9	8.0	7.3
Mineral constituents in parts per million				
Calcium (Ca)	20	3.2	6.4	6.4
Magnesium (Mg)	12.0	4.6	8.8	7.7
Sodium (Na)	10.0	0.7	5.2	1.2
Potassium (K)	1.6	0.1	0.6	0.5
Carbonate (CO_3)	4	0.0	0.0	0.0
Bicarbonate (HCO_3)	97	35	67	56
Sulfate (SO_4)	11	1.0	4.0	1.4
Chloride (Cl)	14.0	0.0	4.2	0.6
Nitrate (NO_3)	0.8	0.0	0.3	0.1
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.23	0.0	0.1	0.0
Silica (SiO_2)	18	11	15	15
Total dissolved solids in parts per million	125	40	78	63
Percent sodium	28	4	19	5
Hardness as $CaCO_3$ in parts per million				
Total	84	27	58	45
Noncarbonate	9	0.0	3	0.0
Turbidity	130	0.0	40	2
Coliform in most probable number per milliliter	7,000.	0.045 -	23.	0.045 -
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.95	0.00	0.80	0.00
Solid alpha	0.68	0.00	0.0	0.00
Diasolved bata	84.2	0.00	2.1	0.0
Solid beta	16.07	0.00	8.6	7.2

WATER QUALITY VARIATIONS



TRINITY RIVER AT LEWISTON (STA. NO. 4a)

TRINITY RIVER NEAR BURNT RANCH (STA. 4b)

Sampling Point. The Burnt Ranch station is located in Section 19 of Township 5 North, Range 7 East, Humboldt Base and Meridian. Monthly grab samples were collected from mid-depth, from the right bank, 500 feet upstream from Highway 299 bridge at Cedar Flat, and 2.3 miles southeast of the town of Burnt Ranch.

Period of Record. April 1958 through December 1961.

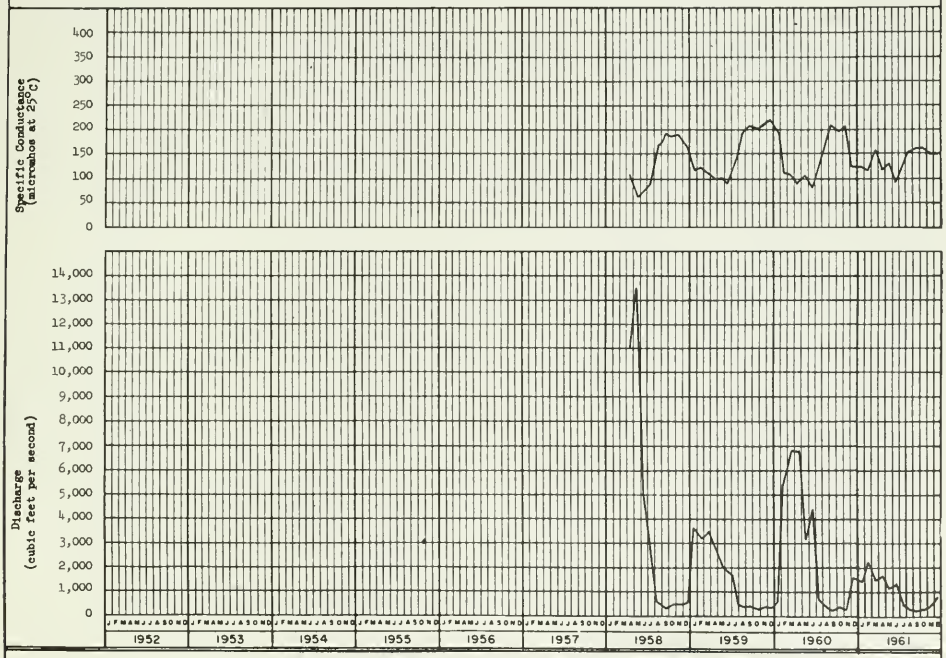
Water Quality Characteristics. Analyses from Station 4b show the water to be excellent in quality, calcium bicarbonate in character, class 1 for irrigation, soft to slightly hard, and within drinking water standards for mineral content.

Significant Water Quality Changes. Influence of the Trinity Dam was noticeable at this station during 1961.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	214	64.6	164	93
Temperature in °F	77	37	76	44
Dissolved oxygen in parts per million	12.8	6.8	11.7	7.9
Percent saturation	102	72	102	93
pH	8.3	7.2	8.3	7.3
Mineral constituents in parts per million				
Calcium (Ca)	22	5.6	17	15
Magnesium (Mg)	12	3.9	7.7	5.7
Sodium (Na)	12	0.7	4.6	1.1
Potassium (K)	2.0	0.1	0.7	0.6
Carbonate (CO_3)	4	0.0	1	0.0
Bicarbonate (HCO_3)	113	36	86	47
Sulfate (SO_4)	23	0.0	5.0	4.0
Chloride (Cl)	12	0.5	7.0	1.1
Nitrate (NO_3)	0.9	0.0	0.3	0.0
Fluoride (F)	0.3	0.0	0.1	0.0
Boron (B)	0.15	0.0	0.1	0.0
Silica (SiO_2)	25	7.5	17	11
Total dissolved solids in parts per million	143	46	104	59
Percent sodium	20	4	13	5
Hardness as $CaCO_3$ in parts per million				
Total	100	30	74	43
Noncarbonate	13	0.0	7	0.0
Turbidity	85	1	6	2
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.41	0.00	0.24	0.0
Solid alpha	0.56	0.09	0.56	0.24
Dissolved beta	15.56	0.00	0.3	0.0
Solid beta	9.4	0.00	9.4	6.0

WATER QUALITY VARIATIONS



TRINITY RIVER NEAR BURNT RANCH (STA. NO. 4b)

TRINITY RIVER NEAR HOOPA (STA. 4)

Sampling Point. Station 4 is located in Section 31 of Township 8 North, Range 5 East, Humboldt Base and Meridian. Monthly water samples were collected from the left bank at the USGS gage, 2 miles southeast of Hoopa, 0.5 mile downstream from Campbell Creek on the Hoopa Indian Reservation, and 12 miles upstream from its confluence with Klamath River.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Trinity River at Station 4 is excellent in quality, calcium bicarbonate in character, class 1 for irrigation, soft to moderately hard, and within drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	243	84	198	118
Temperature in °F	80	39	74	45
Dissolved oxygen in parts per million	14.0	6.7	11.4	8.3
Percent saturation	128	55	105	93
pH	10.0	5.2	8.3	7.3
Mineral constituents in parts per million				
Calcium (Ca)	27	7.0	23	16
Magnesium (Mg)	15	2.3	8.3	5.6
Sodium (Na)	8.4	0.9	5.1	0.9
Potassium (K)	1.6	0.1	0.8	0.4
Carbonate (CO_3)	2	0.0	2	0.0
Bicarbonate (HCO_3)	126	47	107	64
Sulfate (SO_4)	12	0.6	7.6	5.0
Chloride (Cl)	12	0.0	6.4	0.5
Nitrate (NO_3)	1.2	0.0	0.2	0.0
Fluoride (F)	0.3	0.0	0.1	0.0
Boron (B)	0.21	0.0	0.2	0.0
Silica (SiO_2)	21	11	16	15
Total dissolved solids in parts per million	148	56	121	72
Percent sodium	18	3	12	3
Hardness as $CaCO_3$ in parts per million				
Total	120	40	92	59
Noncarbonate	17	0.0	10	0.0
Turbidity	250	0.0	47	1
Coliform in most probable number per milliliter	7,000.	0.045 -	6.2	0.045 -
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.92	0.00	0.08	0.0
Solid alpha	0.54	0.00	0.16	0.0
Dissolved beta	36.46	0.00	2.3	1.6
Solid beta	8.4	0.00	8.4	5.2

WATER QUALITY VARIATIONS

TRINITY RIVER NEAR HOOPA (STA. NO. 4)

Smith River Basin

The California portion of the Smith River Basin occupies approximately 780 square miles in the extreme northwest portion of the North Coastal Region. The major portion of the area is drained by the Smith River whose Middle and South Forks originate on the western slope of the Siskiyou Mountains, and whose North Fork has its headwaters in Curry County, Oregon. The basin is bounded by the Pacific Ocean on the west, the California-Oregon state line to the north, the Del Norte-Siskiyou County line to the east, and the Klamath River watershed divide to the south.

Topography of the area is generally mountainous though interrupted with numerous steep-walled canyons and stream valleys. Elevation varies from sea level to heights of over 6,000 feet. Total average annual runoff in the Smith River Basin is on the order of 2,900,000 acre-feet.

Rough but relatively low mountains cover approximately 95 percent of this river unit. The Smith River Plain which lies along the coast covers about 50 square miles of agriculturally adaptable land. Logging and forest products constitute the largest source of income, followed in order of their importance by agriculture (dairying and bulb raising), mineral production, recreation, and commercial fishing.

Waste discharges constitute only a minor source of inflow to the Smith River watershed and have not created a water impairment problem.

A surface water sampling station is maintained on Smith River near Crescent City to monitor quality of runoff from this basin.

SMITH RIVER NEAR CRESCENT CITY (STA. 3a)

Sampling Point. Station 3a is located in Section 10 of Township 16 North, Range 1 East, Humboldt Base and Meridian. Monthly grab samples were collected from the left bank at the USGS gage, 8 miles east of Crescent City, 0.5 mile downstream from the south fork of the Smith River, and about 12 miles upstream from the mouth.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Analyses of this water show it to be excellent in quality, magnesium bicarbonate in character, class 1 for irrigation, and soft to slightly hard. It has consistently met drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	147	65	137	76.0
Temperature in °F	78	39	69	46
Dissolved oxygen in parts per million	14.7	6.8	11.7	9.2
Percent saturation	135	59	107	97
pH	8.6	6.3	8.2	7.1
Mineral constituents in parts per million				
Calcium (Ca)	11	2.6	7.2	4.9
Magnesium (Mg)	13	3.4	12	6.2
Sodium (Na)	6.5	0.6	3.7	0.6
Potassium (K)	0.7	0.0	0.2	0.0
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	89	36	80	42
Sulfate (SO_4)	7.7	0.0	4.0	0.0
Chloride (Cl)	7.5	0.0	4.8	1.4
Nitrate (NO_3)	1.5	0.0	0.2	0.0
Fluoride (F)	0.2	0.0	0.0	0.0
Boron (B)	0.18	0.0	0.1	0.0
Silica (SiO_2)	27	11	13	13
Total dissolved solids in parts per million	94	41	86	47
Percent sodium	20	3	19	3
Hardness as $CaCO_3$ in parts per million				
Total	76	32	68	34
Noncarbonate	11	0.0	6	0.0
Turbidity	55	0.0	8	1
Coliform in most probable number per milliliter	230.	0.045 -	230.	0.045 -
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.83	0.00	0.08	0.08
Solid alpha	0.70	0.00	0.24	0.0
Dissolved beta	39.68	0.00	8.1	6.0
Solid beta	23.27	0.00	12.9	3.9

WATER QUALITY VARIATIONS

SMITH RIVER NEAR CRESCENT CITY (STA. NO. 3a)

Redwood Creek and Mad River Unit

Redwood Creek drains an area of about 279 square miles north of Mad River Basin in Humboldt County. Mad River is a large stream, draining a total of 496 square miles in Humboldt and Trinity Counties. Both of these streams enter the Pacific Ocean and estimated mean annual runoffs of Redwood Creek and Mad River are 823,500 and 925,500 acre-feet, respectively. Like other streams in the North Coastal Region, precipitation and runoff are high during the winter months and generally quite low in the late summer and fall.

In both of these stream basins a total of only 21 square miles is classed as valley and mesa land, the remaining area being a rugged mountainous terrain. Lumbering activities comprise the major users of surface waters in these basins; however, water is diverted from Mad River for use as a municipal supply for the communities of Arcata and Eureka. Both of these streams support runs of anadromous fish and resident trout and are considered to have significant value as recreational areas.

Waste discharges entering these streams are insignificant and do not cause an impairment problem.

The following tabulation presents the names of stations maintained to monitor quality of surface water in this basin and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Redwood Creek at Orick	44
Mad River at Arcata	46

REDWOOD CREEK AT ORICK (STA. 3b)

Sampling Point. Redwood Creek sampling station is located in Section 4 of Township 10 North, Range 1 East, Humboldt Base and Meridian. Monthly grab samples were collected from the left bank of the downstream side of the U. S. Highway 101 bridge at Orick and about two miles upstream from the mouth.

Period of Record. November 1958 through December 1961.

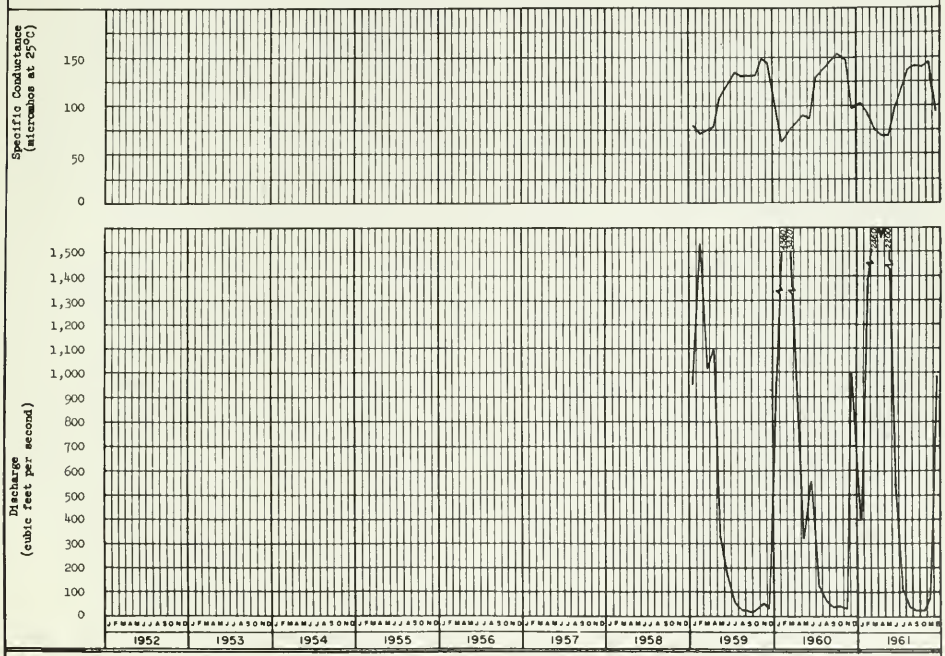
Water Quality Characteristics. Analyses show the water at Station 3b to be excellent in quality, calcium bicarbonate in character, class 1 for irrigation, soft to slightly hard, and within drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	158	68.6	148	72
Temperature in °F	69	42	69	43
Dissolved oxygen in parts per million	11.6	7.6	10.7	8.7
Percent saturation	102	77	101	83
pH	8.0	6.9	8.0	7.1
Mineral constituents in parts per million				
Calcium (Ca)	24	8.8	20	9.2
Magnesium (Mg)	4.3	1.0	2.6	1.6
Sodium (Na)	7.3	2.0	5.1	1.1
Potassium (K)	1.0	0.0	0.9	0.6
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	73	22	66	31
Sulfate (SO_4)	16	1.9	7.0	4.4
Chloride (Cl)	10	4.0	6.8	2.8
Nitrate (NO_3)	0.2	0.0	0.1	0.0
Fluoride (F)	0.2	0.0	0.2	0.0
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	13	4.7	8.1	7.3
Total dissolved solids in parts per million	96	41	88	43
Percent sodium	23	7	23	7
Hardness as $CaCO_3$ in parts per million				
Total	68	28	64	29
Noncarbonate	16	0.0	15	1
Turbidity	550	1	70	1
Coliform in most probable number per milliliter	7,000. +	0.5	620.	0.5
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.40	0.00	0.40	0.0
Solid alpha	0.44	0.00	0.24	0.0
Dissolved beta	5.2	0.00	5.2	3.4
Solid beta	8.4	0.00	8.4	1.2

WATER QUALITY VARIATIONS



REDWOOD CREEK AT ORICK (STA. NO. 3b)

MAD RIVER NEAR ARCATA (STA. 6a)

Sampling Point. Station 6a is located in Section 15 of Township 6 North, Range 1 East, Humboldt Base and Meridian. Monthly water samples are collected from the right bank 100 feet upstream from Highway 299 bridge, about 4.5 miles upstream from the mouth, and 3 miles northeast of Arcata.

Period of Record. November 1958 through December 1961.

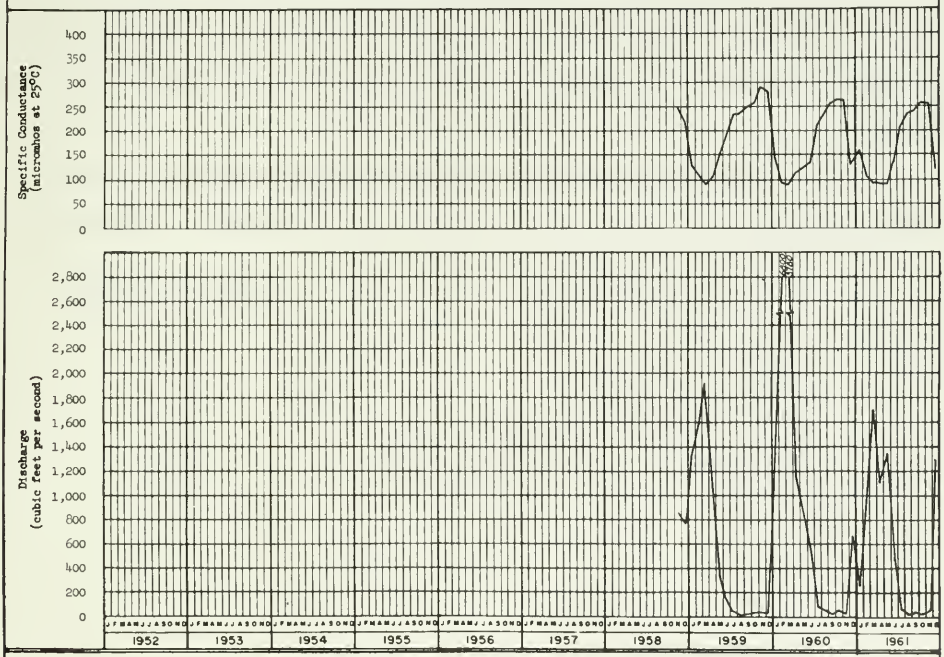
Water Quality Characteristics. Runoff in Mad River is excellent in quality, calcium bicarbonate in character, class 1 for irrigation, soft to moderately hard, and within drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	283	95.1	258	97
Temperature in °F	72	42	68	48
Dissolved oxygen in parts per million	12.5	8.0	11.0	8.0
Percent saturation	109	70	103	70
pH	8.3	7.1	8.3	7.1
Mineral constituents in parts per million				
Calcium (Ca)	41	11	36	11
Magnesium (Mg)	8.1	1.7	6.3	3.5
Sodium (Na)	8.6	1.1	8.6	1.1
Potassium (K)	1.5	0.5	1.2	0.8
Carbonate (CO_3)	2.0	0.0	2.0	0.0
Bicarbonate (HCO_3)	146	42	140	44
Sulfate (SO_4)	19	3.8	11	4.0
Chloride (Cl)	14	2.2	6.5	2.2
Nitrate (NO_3)	1.3	0.0	0.4	0.2
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.2	0.0	0.1	0.0
Silica (SiO_2)	14	5.9	13	10
Total dissolved solids in parts per million	174	59	159	60
Percent sodium	19	5	19	5
Hardness as $CaCO_3$ in parts per million				
Total	136	41	124	42
Noncarbonate	17	0.0	16	1.0
Turbidity	700	1	160	2
Coliform in most probable number per milliliter	7,000.	0.045 -	2,400.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.24	0.00	0.08	0.0
Solid alpha	1.6	0.00	1.6	0.25
Dissolved beta	4.61	0.00	0.0	0.0
Solid beta	8.62	0.00	3.3	1.0

WATER QUALITY VARIATIONS



MAD RIVER NEAR ARCATA (STA. NO. 6a)

Eel River Basin

The Eel River watershed traverses the south-central portion of the North Coastal Region. It drains an area of 3,701 square miles of which 3,574 square miles are rugged mountains, scarred by numerous landslides and narrow, steep stream canyons. Several small river terraces and a broad coastal plain constitute the remaining 127 square miles in the basin. The Eel River has an average annual discharge of about 6,273,000 acre-feet.

Eel River water is used for irrigation, power development, industry, recreation, and public and domestic water supplies. Except for power diversions which discharge to Russian River Basin, these users divert extremely small quantities and the abundant water resources of this basin are largely undeveloped. Lumber by-product industries and irrigation are considered the most probable future users of significant quantities of water within the basin.

Waste discharges and irrigation return entering the Eel River at the present time are small in quantity and do not significantly impair the receiving water.

The following tabulation lists the stations maintained to monitor surface water quality in this basin and the page on which each is discussed.

EEL RIVER NEAR DOS RIOS (STA. 5d)

Sampling Point. Station 5d is located in Section 31 of Township 21 North, Range 13 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected in the center of the channel from the highway bridge, 250 feet upstream from the confluence of Outlet Creek, 7.5 miles northeast of Longvale, and 8.5 miles south of Dos Rios.

Period of Record. April 1958 through December 1961.

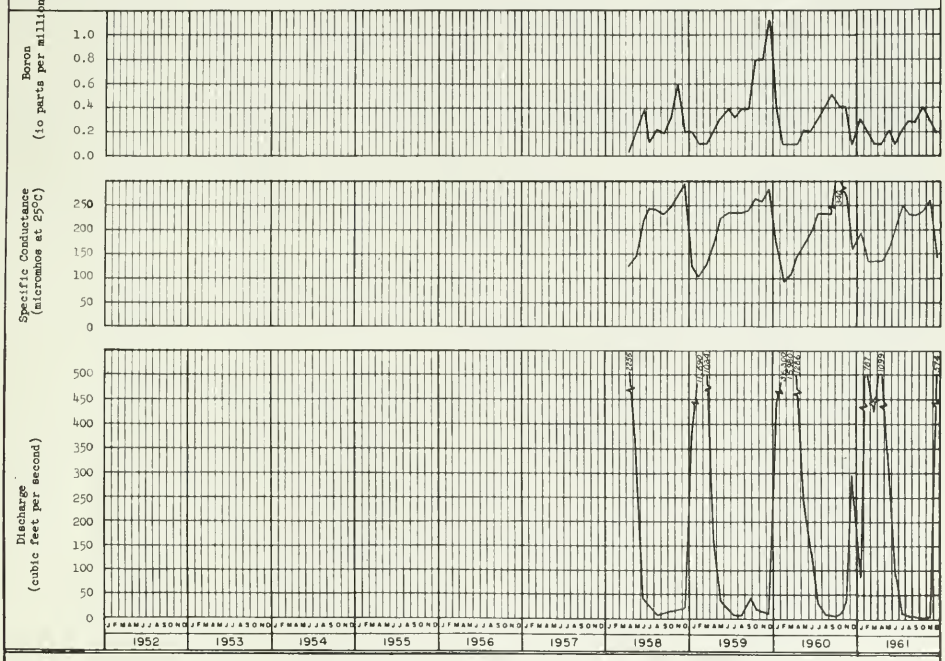
Water Quality Characteristics. Past analyses identify the water at Station 5d as good in quality, calcium bicarbonate in character, soft to moderately hard, and within drinking water standards for mineral content. At times boron concentrations of 0.5 ppm are found, placing this water in class 2 for irrigation. Although the source of boron in this river has not yet been identified, evidence indicates the boron originates from geologic formations existing in the watershed upstream from and in the vicinity of this station. Runoff from numerous mineralized springs, probably of deep-seated origin, also enter the waterway of Eel River upstream from this station. It has been established that springs high in boron exist throughout much of the Clear Lake area which is adjacent to the upper watershed of this basin.

Significant Water Quality Changes. None

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	340	88.5	262	134
Temperature in °F	84	40	80	44
Dissolved oxygen in parts per million	13.2	6.9	11.5	7.6
Percent saturation	120	78	120	85
pH	8.6	7.0	8.6	7.3
Mineral constituents in parts per million				
Calcium (Ca)	35	12	25	18
Magnesium (Mg)	12	3.9	7.9	6.8
Sodium (Na)	25	2.7	10	2.4
Potassium (K)	1.6	0.7	1.2	0.8
Carbonate (CO_3)	5	0.0	5	0.0
Bicarbonate (HCO_3)	146	40	132	68
Sulfate (SO_4)	27	6.7	18	10
Chloride (Cl)	12	0.8	7.0	0.8
Nitrate (NO_3)	1.3	0.0	0.2	0.0
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	1.1	0.01	0.4	0.1
Silica (SiO_2)	14	4.2	14	8.1
Total dissolved solids in parts per million	204	53	157	80
Percent sodium	35	7	19	7
Hardness as $CaCO_3$ in parts per million				
Total	136	42	114	59
Noncarbonate	17	0.0	8	1
Turbidity	1,250	1	60	1
Coliform in most probable number per milliliter				
Radioactivity in micro-micro curies per liter				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid beta				

WATER QUALITY VARIATIONS



EEL RIVER NEAR DOS RIOS (STA. NO. 5d)

EEL RIVER NEAR McCANN (STA. 5)

Sampling Point. The McCann station is located in Section 3 of Township 2 South, Range 3 East, Humboldt Base and Meridian. Monthly water samples were collected from the center of the channel, from the McCann Bridge 46.5 miles upstream from the mouth.

Period of Record. April 1951 through December 1961.

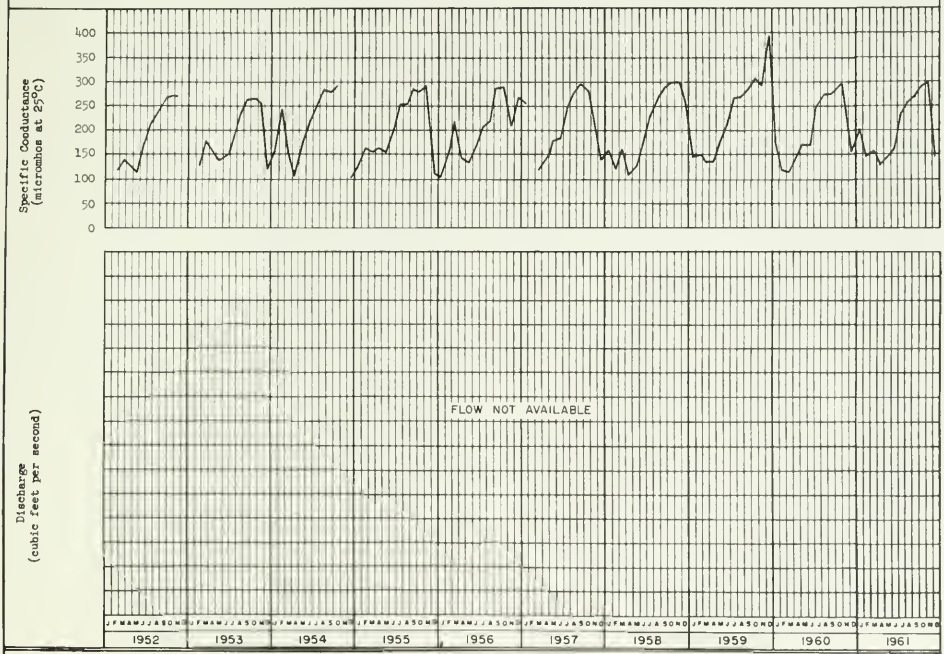
Water Quality Characteristics. Eel River water near McCann is calcium bicarbonate in character, class 1 for irrigation uses, with a range from soft to moderately hard, and consistently meets drinking water standards for mineral content. Boron decreases significantly from Station 5d to Station 5, the downstream station. Boron concentrations at Station 5 range from 0 to 0.2 ppm. This decrease in boron between the two stations is attributable to low boron content waters tributary to the Eel River between the two stations.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	399	101	295	131
Temperature in °F	82	42	76	45
Dissolved oxygen in parts per million	15.4	6.6	11.6	8.4
Percent saturation	150	54	104	71
pH	8.6	6.8	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	40	9.8	34	17
Magnesium (Mg)	11	2.9	8.6	5.7
Sodium (Na)	16	1.6	8.8	1.6
Potassium (K)	2.7	0.5	1.3	1.0
Carbonate (CO_3)	4	0.0	4	0.0
Bicarbonate (HCO_3)	230	53	137	68
Sulfate (SO_4)	26	7.7	22	9.0
Chloride (Cl)	20	0.0	10	1.2
Nitrate (NO_3)	0.7	0.0	0.2	0.0
Fluoride (F)	0.3	0.0	0.1	0.0
Boron (B)	0.30	0.0	0.3	0.0
Silica (SiO_2)	14	7	14	12
Total dissolved solids in parts per million	214	54	159	70
Percent sodium	26	5	12	5
Hardness as $CaCO_3$ in parts per million				
Total	204	41	133	61
Noncarbonate	41	0.0	21	4
Turbidity	1,100	0.0	92	1
Coliform in most probable number per milliliter	7,000. +	0.045 -	62.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.43	0.00	0.16	0.0
Solid alpha	0.69	0.00	0.69	0.24
Dissolved beta	45.1	0.00	7.2	0.0
Solid beta	34.6	0.00	8.8	0.0

WATER QUALITY VARIATIONS



EEL RIVER NEAR McCANN (STA. NO. 5)

EEL RIVER AT SCOTIA (STA. 6)

Sampling Point. The station on Eel River at Scotia is located in Section 5 of Township 1 North, Range 1 East, Humboldt Base and Meridian. Monthly grab samples were collected from the left bank approximately 0.6 mile downstream from Highway 101 bridge between Scotia and Rio Dell at the foot of Painter Street, and about 12 miles upstream from the mouth, or in low flows 300 feet upstream from the Highway 101 bridge north of Rio Dell.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. The water at Station 6 is excellent in quality, generally calcium bicarbonate in character, slightly hard to moderately hard, and within the recommended limits for mineral content in drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	441	98.0	294	145
Temperature in °F	83	42	76	.50
Dissolved oxygen in parts per million	18.2	6.2	11.8	9.3
Percent saturation	217	50	128	82
pH	9.0	6.3	8.5	7.3
Mineral constituents in parts per million				
Calcium (Ca)	43	12	33	16
Magnesium (Mg)	25	2.2	9.8	6.3
Sodium (Na)	16	2.7	9.6	2.7
Potassium (K)	3.2	0.6	1.4	0.9
Carbonate (CO_3)	6	0.0	5	0.0
Bicarbonate (HCO_3)	239	42	148	68
Sulfate (SO_4)	17	5.0	16	9.0
Chloride (Cl)	20	1.0	8.5	3.5
Nitrate (NO_3)	1.2	0.0	1.2	0.2
Fluoride (F)	0.3	0.0	0.1	0.1
Boron (B)	0.48	0.0	0.2	0.0
Silica (SiO_2)	15	3.4	15	8.5
Total dissolved solids in parts per million	254	57	170	84
Percent sodium	26	8	18	8
Hardness as $CaCO_3$ in parts per million				
Total	212	43	136	65
Noncarbonate	23	0.0	13	0.0
Turbidity	1,100	0.0	200	1
Coliform in most probable number per milliliter	7,000. +	0.045 -	62.	0.12
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.73	0.00	0.0	0.00
Solid alpha	1.22	0.00	0.34	0.0
Dissolved beta	10.30	0.00	7.4	0.4
Solid beta	13.90	0.00	5.8	2.5

WATER QUALITY VARIATIONS

EEL RIVER AT SCOTIA (STA. NO. 6)

OUTLET CREEK NEAR LONGVALE (STA. 5b)

Sampling Point. The station is located in Section 31 of Township 21 North, Range 13 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, 300 feet downstream from the railroad bridge, 200 feet upstream from the confluence with the Eel River, 7.5 miles northeast of Longvale and 8.5 miles south of Dos Rios.

Period of Record. May 1958 through December 1960.

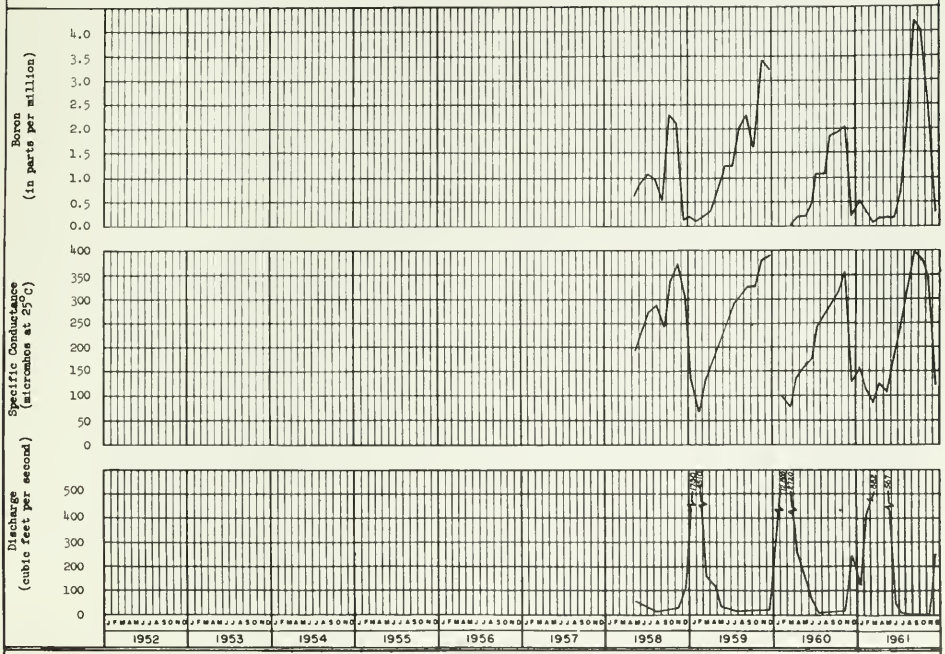
Water Quality Characteristics. Since inception of a monitoring station on Outlet Creek, waters have been calcium bicarbonate in character, slightly to moderately hard and within drinking water standards for mineral content. The water in Outlet Creek, because of boron concentrations, ranges from class 1 to class 3 for irrigation use. Boron usually exceeds 0.5 ppm and periodically reaches values in excess of 2.0 ppm.

Significant Water Quality Changes. During 1960, boron concentrations in Outlet Creek reached a maximum of 2.1 ppm in November causing the water to be class 3 for irrigation. In 1961 the maximum boron concentration recorded was 4.2 ppm. This value is also the maximum of record for boron at this station. The high concentration of boron is attributed to the lack of dilution waters in Outlet Creek. The source of boron degradation to Outlet Creek has not as yet been ascertained. However, it is believed that the source, as in the headwaters of the Eel River, is geologic formations and springs.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	390	58.2	396	88
Temperature in °F	81	38	80	46
Dissolved oxygen in parts per million	12.8	6.0	11.2	7.1
Percent saturation	118	69	98	79
pH	8.4	6.8	8.4	7.2
Mineral constituents in parts per million				
Calcium (Ca)	60	4.8	35	9.6
Magnesium (Mg)	16	0.1	16	5.1
Sodium (Na)	25	2.6	25	3.1
Potassium (K)	2.9	0.4	1.8	0.5
Carbonate (CO_3)	5	0.0	5	0.0
Bicarbonate (HCO_3)	186	18	170	42
Sulfate (SO_4)	14	1.0	7.0	6.0
Chloride (Cl)	38	2.2	38	2.4
Nitrate (NO_3)	1.5	0.0	0.4	0.0
Fluoride (F)	0.3	0.0	0.1	0.1
Boron (B)	4.2	0.0	4.2	0.1
Silica (SiO_2)	16	5.8	14	13
Total dissolved solids in parts per million	234	42	229	53
Percent sodium	31	10	29	10
Hardness as $CaCO_3$ in parts per million				
Total	164	24	152	36
Noncarbonate	23	0.0	6	0.0
Turbidity	700	0.8	30	1
Coliform in most probable number per milliliter				
Radioactivity in micro-micro curies per liter				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid beta				

WATER QUALITY VARIATIONS



OUTLET CREEK NEAR LONGVALE (STA. NO. 5b)

EEL RIVER, MIDDLE FORK AT DOS RIOS (STA. 5c)

Sampling Point. Station 5c is located in Section 6 of Township 21 North, Range 13 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the center of the channel from the highway bridge 0.5 mile southeast of Dos Rios and 0.2 mile upstream from the confluence with Eel River.

Period of Record. April 1958 through December 1961.

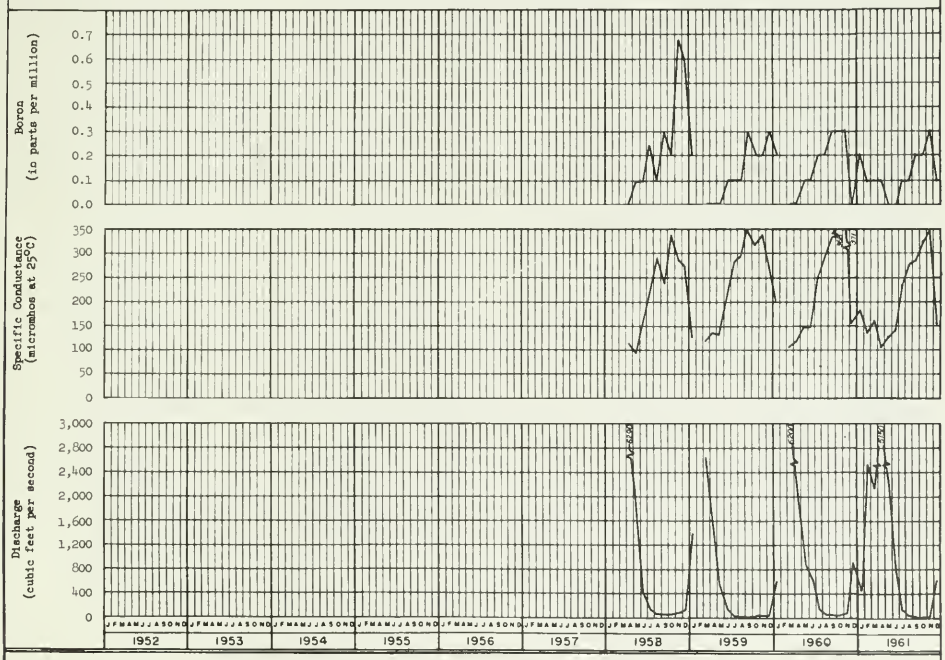
Water Quality Characteristics. A review of analyses of samples reveals water at this station to be calcium bicarbonate in character, class 1 for irrigation, soft to moderately hard, and to consistently meet drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	374	90.7	348	103
Temperature in °F	80	40	80	43
Dissolved oxygen in parts per million	12.8	6.4	11.8	8.3
Percent saturation	112	79	112	92
pH	8.5	6.9	8.5	7.3
Mineral constituents in parts per million				
Calcium (Ca)	39	12	32	15
Magnesium (Mg)	12	2.4	9.4	5.5
Sodium (Na)	18	1.3	15	1.3
Potassium (K)	1.8	0.3	1.1	0.9
Carbonate (CO_3)	6	0.0	6	0.0
Bicarbonate (HCO_3)	154	46	130	56
Sulfate (SO_4)	43	1.9	30	7.0
Chloride (Cl)	29	0.3	24	0.3
Nitrate (NO_3)	1.0	0.0	0.0	0.0
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.68	0.0	0.3	0.0
Silica (SiO_2)	16	3.9	14	7.9
Total dissolved solids in parts per million	220	54	205	61
Percent sodium	21	4	18	4
Hardness as $CaCO_3$ in parts per million				
Total	160	40	146	50
Noncarbonate	50	0.0	36	4
Turbidity	700	1	55 *	1
Coliform in most probable number per milliliter				
Radioactivity in micro-micro curies per liter				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid beta				

WATER QUALITY VARIATIONS



EEL RIVER, MIDDLE FORK AT DOS RIOS (STA. NO. 5c)

EEL RIVER, SOUTH FORK NEAR MIRANDA (STA. 7)

Sampling Point. Station 7 is located in Section 30 of Township 3 South, Range 4 East, Humboldt Base and Meridian. Monthly water samples were collected from the right bank, at the USGS gage at Sylvandale camp grounds on U. S. Highway 101, 6 miles south of Miranda and about 12 miles upstream from the confluence with Eel River.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Past records show South Fork Eel River water to be excellent in quality, calcium bicarbonate in character, class 1 for irrigation, soft to moderately hard, and within the recommended limits for minerals in drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	270	75.9	255	120
Temperature in °F	79	38	78	46
Dissolved oxygen in parts per million	14.8	5.2	11.2	8.7
Percent saturation	166	39	124	90
pH	8.8	6.4	8.6	7.1
Mineral constituents in parts per million				
Calcium (Ca)	32	5.6	27	12
Magnesium (Mg)	12	2.8	8.4	5.6
Sodium (Na)	11.0	1.9	9.5	1.9
Potassium (K)	2.3	0.4	1.4	0.7
Carbonate (CO_3)	6	0.0	6	0.0
Bicarbonate (HCO_3)	157	35	140	58
Sulfate (SO_4)	9.6	4.0	8.0	7.0
Chloride (Cl)	15	1.5	8.0	2.8
Nitrate (NO_3)	0.6	0.0	0.2	0.1
Fluoride (F)	0.3	0.0	0.1	0.1
Boron (B)	0.5	0.00	0.2	0.0
Silica (SiO_2)	86	4.0	17	9.9
Total dissolved solids in parts per million	161	45	152	71
Percent sodium	24	5	19	5
Hardness as $CaCO_3$ in parts per million				
Total	124	28	118	51
Noncarbonate	14	0.0	4	0.0
Turbidity	1,500	0.0	120	1
Coliform in most probable number per milliliter	2,400.	0.045 -	230.	0.06
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.22	0.00	0.24	0.0
Solid alpha	0.79	0.00	0.71	0.40
Dissolved beta	19.5	0.00	0.2	0.0
Solid beta	13.54	0.00	5.8	0.0

WATER QUALITY VARIATIONS

EEL RIVER, SOUTH FORK NEAR MIRANDA (STA. NO. 7)

VAN DUZEN RIVER NEAR BRIDGEVILLE (STA. 5a)

Sampling Point. The station is located in Section 17 of Township 1 North, Range 3 East, Humboldt Base and Meridian. Monthly water samples were collected at the USGS gage, from the center of the channel from the bridge on Highway 36, 0.3 mile downstream from Pip Creek, 0.5 mile upstream from Rogers Creek, 4 miles west of Bridgeville and about 20 miles upstream from its confluence with Eel River.

Period of Record. April 1958 through December 1961.

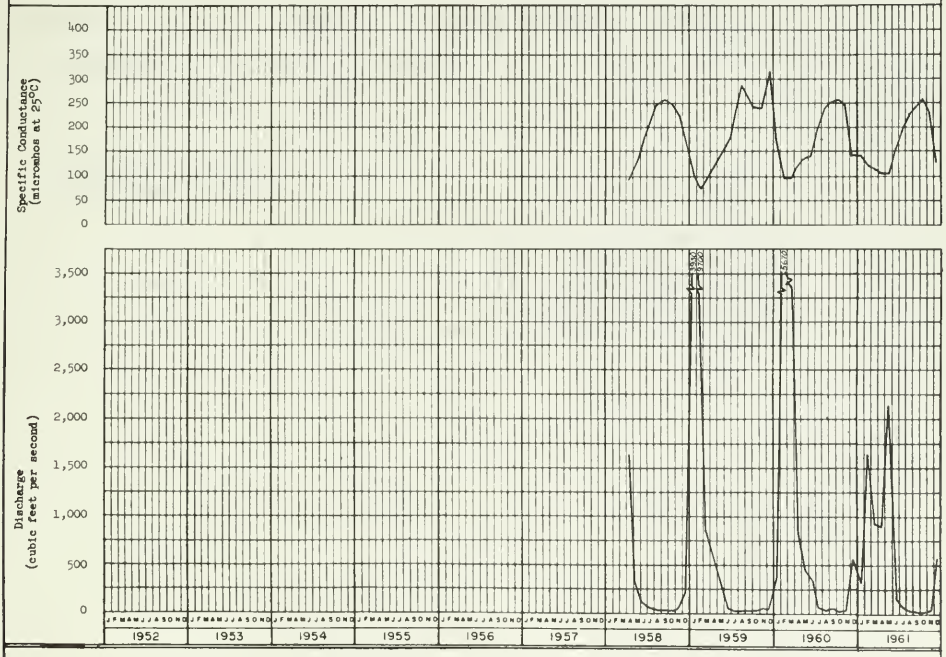
Water Quality Characteristics. Water at Station 5a is calcium bicarbonate in character, class 1 for irrigation, ranging from soft to moderately hard. It meets drinking water standards for mineral content. The quality of this water does not differ significantly from the quality of Eel River water at Scotia.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	319	71.5	252	104
Temperature in °F	80	38	68	44
Diseolved oxygen in parts per million	12.6	7.6	11.3	8.5
Percent saturation	112	76	108	76
pH	8.4	7.0	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	39	8.8	32	12
Magnesium (Mg)	10	1.5	8.0	4.1
Sodium (Na)	11	1.0	7.5	1.0
Potassium (K)	1.9	0.3	1.0	1.0
Carbonate (CO_3)	6	0.0	3	0.0
Bicarbonate (HCO_3)	166	37	132	54
Sulfate (SO_4)	35	1.9	17	6.0
Chloride (Cl)	8.0	0.2	5.0	0.2
Nitrate (NO_3)	1.8	0.0	0.4	0.1
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	14	7.2	14	10
Total dissolved solids in parts per million	207	47	156	65
Percent sodium	21	4	14	4
Hardness as $CaCO_3$ in parts per million				
Total	152	28	115	47
Noncerbonate	25	0.0	10	0.0
Turbidity	700	1	60	1
Coliform in most probable number per milliliter	620.	0.045 -	620.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.74	0.00	0.74	0.0
Solid alpha	0.63	0.06	0.34	0.06
Dissolved beta	6.30	0.0	5.2	0.0
Solid beta	10.2	0.00	10.2	0.4

WATER QUALITY VARIATIONS



VAN DUZEN RIVER NEAR BRIDGEVILLE (STA. NO. 5a)

Mattole River-Mendocino Coast Unit

The unit is comprised of several noncontiguous watersheds draining the south coastal portion of Region 1 and includes the following rivers: Mattole, Noyo, Big, Navarro, and Gualala. These rivers drain approximately 1,290 square miles of predominantly mountainous coast land with less than one percent of the area being valley and mesa lands. The combined mean seasonal runoff of these rivers is estimated to exceed 2,430,000 acre-feet.

Present development in this area is dependent on the lumber industry and to a limited extent on stock raising. Water development is largely on an individual basis with a few small public agencies formed to develop and distribute domestic and municipal supplies. Waste discharges from lumber industries and small communities have not created any significant water quality impairment problems in these basins.

The following tabulation presents the names of stations maintained to monitor quality of surface water in this unit and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Mattole River near Petrolia	66
Noyo River near Fort Bragg	68
Big River near mouth	70
Navarro River near Navarro	72
Gualala River, South Fork near Annapolis	74

MATTOLE RIVER NEAR PETROLIA (STA. 7a)

Sampling Point. Station 7a is located in Section 11 of Township 2 South, Range 2 West, Humboldt Base and Meridian. Monthly grab samples were collected from the right bank at the USGS gage, 0.2 mile downstream from Clear Creek, 1.3 miles upstream from North Fork, 1.2 miles southeast of Petrolia, Humboldt County, and about 5 miles upstream from the mouth.

Period of Record. January 1959 through December 1961.

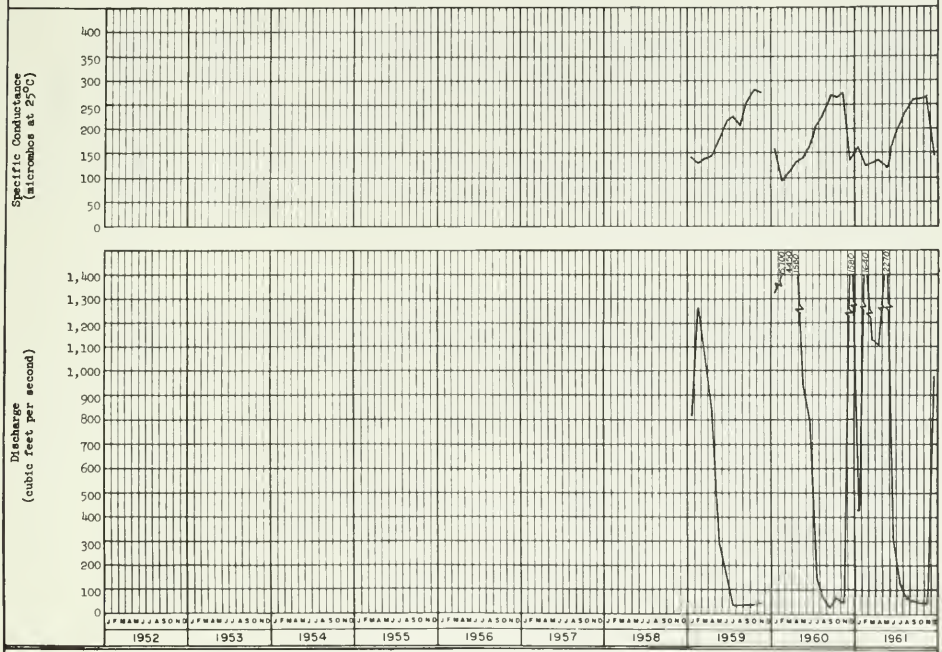
Water Quality Characteristics. Water at Station 7a is calcium bicarbonate in character, excellent in quality, class 1 for irrigation, soft to moderately hard, and within mineral standards for drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	280	98.2	261	118
Temparature in °F	76	45	71	48
Disaolved oxygen in parts per million	12.7	8.2	12.0	8.5
Percent saturation	136	75	118	75
pH	8.3	7.1	8.3	7.1
Mineral constituents in parts per million				
Calcium (Ca)	42	13	36	13
Magnesium (Mg)	7.1	3.6	5.4	3.8
Sodium (Na)	10.0	3.4	9.1	3.4
Potassium (K)	1.8	0.7	1.3	1.2
Carbonate (CO_3)	4	0.0	4	0.0
Bicarbonate (HCO_3)	132	45	124	54
Sulfate (SO_4)	40	8.6	21	9.0
Chloride (Cl)	14	2.8	5.5	2.8
Nitrate (NO_3)	2.0	0.0	0.2	0.1
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	18	2.9	15	13
Total dissolved solids in parts per million	184	59	157	75
Percent sodium	21	10	21	10
Hardness as $CaCO_3$ in parts per million				
Total	134	40	116	48
Noncarbonate	27	1	17	4
Turbidity	1,200	0.8	200	1
Coliform in most probable number per milliliter	2,400.	0.045 -	230.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.27	0.0	0.16	0.0
Solid alpha	0.96	0.00	0.96	0.0
Dissolved beta	2.65	0.00	0.7	0.0
Solid beta	12.91	0.00	7.3	0.0

WATER QUALITY VARIATIONS



MATTOLE RIVER NEAR PETROLIA (STA. NO. 7a)

NOYO RIVER NEAR FORT BRAGG (STA. 10c)

Sampling Point. Station 10c is situated in Section 10 of Township 18 North, Range 17 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at the Fort Bragg Municipal Water Supply intake located approximately five miles upstream from the mouth.

Period of Record. January 1959 through December 1961.

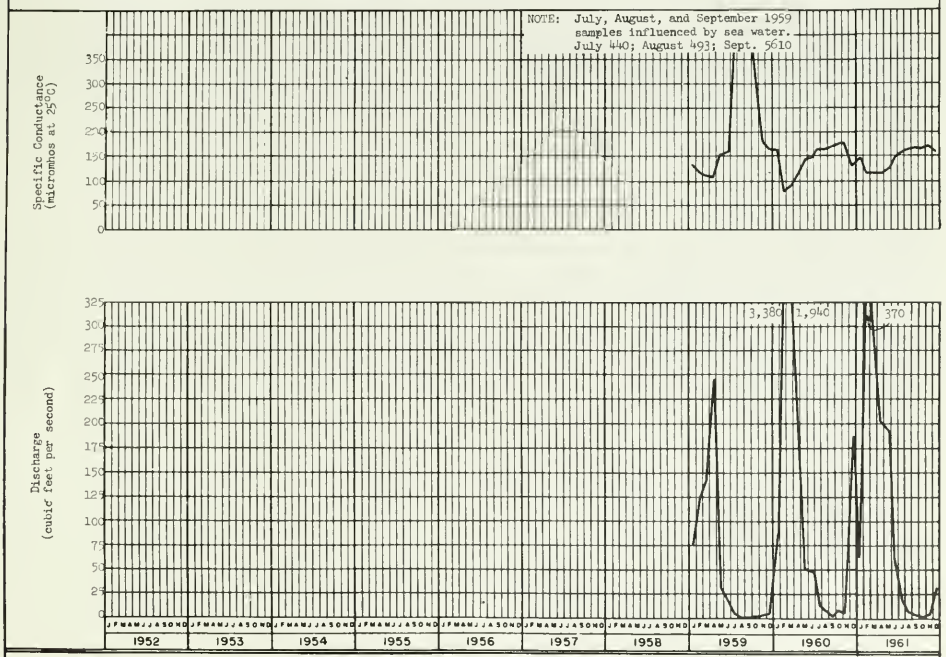
Water Quality Characteristics. Water in this stream is a bicarbonate type with calcium as its major cation. The water is soft to slightly hard. Concentrations of mineral constituents included in the analyses indicate that the water is suitable for drinking and class 1 for irrigation.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	174	77.9	171	114
Temperature in °F	69	41	69	43
Dissolved oxygen in parts per million	11.3	8.2	11.0	8.2
Percent saturation	102	82	101	84
pH	7.4	7.0	7.4	7.1
Mineral constituents in parts per million				
Calcium (Ca)	16	7.6	16	13
Magnesium (Mg)	6.1	2.9	4.9	3.3
Sodium (Na)	13	4.4	11	4.4
Potassium (K)	1.3	0.6	1.2	0.9
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	88	30	88	50
Sulfate (SO_4)	9.0	1.0	5.0	3.4
Chloride (Cl)	12	5.5	12	5.5
Nitrate (NO_3)	0.6	0.0	0.6	0.3
Fluoride (F)	0.2	0.0	0.1	
Boron (B)	0.3	0.0	0.2	0.0
Silica (SiO_2)	21	17	18	
Total dissolved solids in parts per million	120	54	117	78
Percent sodium	31	18	29	18
Hardness as $CaCO_3$ in parts per million				
Total	67	30	65	42
Noncarbonate	6	0.0	2	0
Turbidity	500	1	60	1
Coliform in most probable number per milliliter	2,400.	< 0.045	230.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.24	0.00	0.24	0.00
Solid alpha	0.50	0.10	0.48	0.16
Dissolved beta	12.05	2.4	0.0	0.0
Solid beta	10.4	0.00	10.4	0.0

WATER QUALITY VARIATIONS



NOYO RIVER NEAR FORT BRAGG (STA. NO. 10c)

BIG RIVER NEAR MOUTH (STA. 8c)

Sampling Point. Station 8c is located in Section 24, Township 17 North, Range 17 West, Mt. Diablo Base and Meridian. Monthly water samples were collected from the right bank approximately 12 miles upstream from the mouth, about 9 miles east of Mendocino.

Period of Record. January 1959 through December 1961.

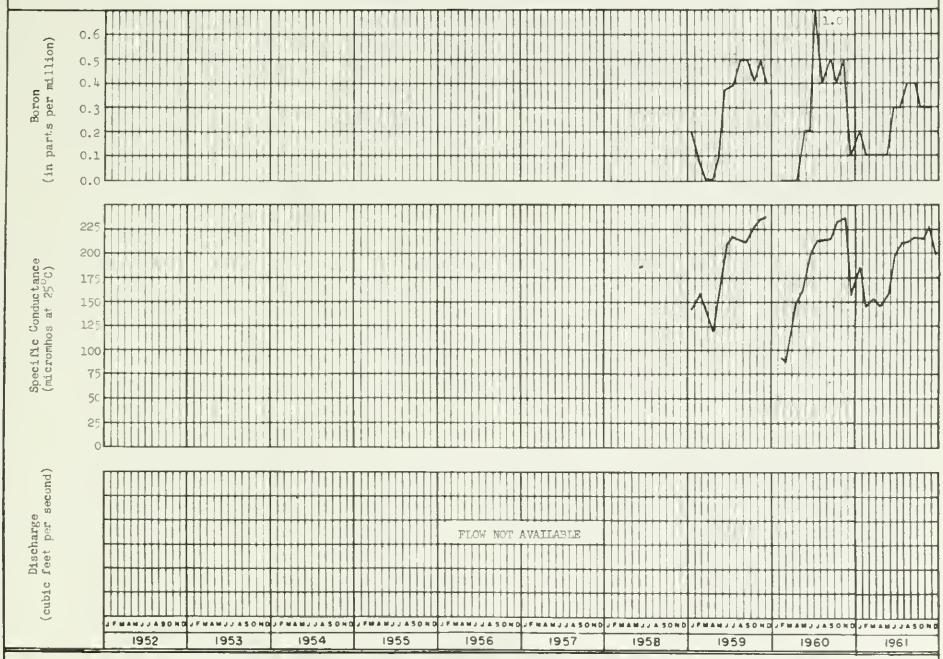
Water Quality Characteristics. Water at Station 8c is excellent in quality, calcium bicarbonate in character, soft to moderately hard and within drinking water standards for mineral content. Although it is class 1 for irrigation throughout the year, boron has exceeded the maximum recommended concentration of 0.5 ppm at various times. The source of the boron in this stream has not as yet been ascertained.

Significant Water Quality Changes. A maximum concentration for boron of 1.0 ppm was recorded in July 1960.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	235	86.4	227	146
Temperature in °F	71	39	71	42
Dissolved oxygen in parts per million	12.0	8.1	12.0	8.5
Percent saturation	102	79	102	79
pH	7.7	7.0	7.6	7.1
Mineral constituents in parts per million				
Calcium (Ca)	30	12	22	18
Magnesium (Mg)	8.2	3.4	7.3	5.1
Sodium (Na)	16	4.5	13	5.2
Potassium (K)	2.8	0.7	1.4	1.1
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	127	34	122	68
Sulfate (SO_4)	14	1.0	7.0	
Chloride (Cl)	16	5.5	8.0	5.5
Nitrate (NO_3)	1.0	0.0	0.7	0.0
Fluoride (F)	0.2	0.0	0.1	
Boron (B)	1.0	0.0	0.4	0.1
Silica (SiO_2)	24	14	19	18
Total dissolved solids in parts per million	154	57	149	96
Percent sodium	28	16	27	16
Hardness as $CaCO_3$ in parts per million				
Total	96	32	90	56
Noncarbonate	13	0.0	0	0
Turbidity	1,440	0.9	160	1
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.82	0.0	0.25	0.08
Solid alpha	0.63	0.09	0.58	0.23
Dissolved beta	6.5	0.00	0.1	0.0
Solid beta	13.4	0.00	13.4	0.0

WATER QUALITY VARIATIONS



BIG RIVER NEAR MOUTH (STA. NO. 8c)

NAVARRO RIVER NEAR NAVARRO (STA. 8b)

Sampling Point. Navarro River sampling Station 8b is located in Section 7 of Township 15 North, Range 16 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank at the USGS gage, 2.7 miles downstream from North Fork, 5.4 miles upstream from the mouth and 6.6 miles west of Navarro.

Period of Record. January 1959 through December 1961.

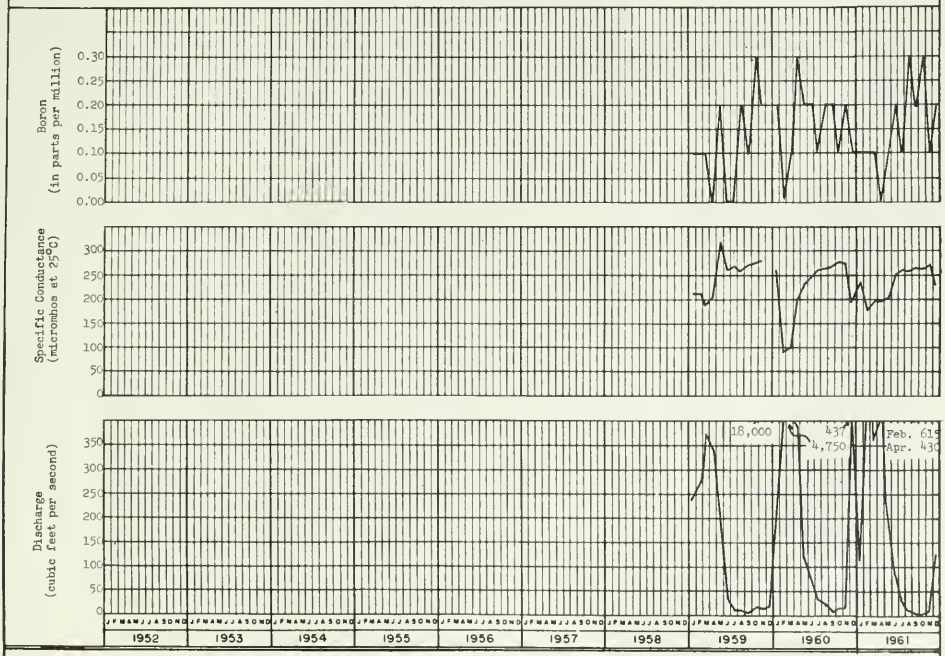
Water Quality Characteristics. Analyses of samples from the Navarro River indicate that the water is calcium-magnesium bicarbonate in character and ranges from soft to slightly hard. Concentrations of mineral consitiuents included in the analyses are within drinking water and class 1 irrigation requirements.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	319	85.1	272	178
Temperature in °F	74	44	73	44
Dissolved oxygen in parts per million	12.0	7.4	11.6	8.0
Percent saturation	132	81	132	81
pH	7.9	6.8	7.9	7.1
Mineral constituents in parts per million				
Calcium (Ca)	30	18	26	24
Magnesium (Mg)	12	7.2	11	7.3
Sodium (Na)	24	2.0	14	2.0
Potassium (K)	2.0	1.0	1.4	1.2
Carbonate (CO_3)	7	0.0	0.0	0.0
Bicarbonate (HCO_3)	155	38	150	86
Sulfate (SO_4)	25	5.0	11	8.0
Chloride (Cl)	29	6.0	10	6.0
Nitrate (NO_3)	1.3	0.0	0.5	
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.3	0.0	0.3	0.0
Silica (SiO_2)	21	15	18	17
Total dissolved solids in parts per million	188	52	166	108
Percent sodium	32	4	22	4
Hardness as $CaCO_3$ in parts per million				
Total	126	38	118	71
Noncarbonate	11	0.0	3	0.0
Turbidity	140	0.0	140	2
Coliform in most probable number per milliliter	2,400.	<0.045	2,400.	0.13
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.16	0.00	0.15	0.00
Solid alpha	0.55	0.00	0.45	0.00
Dissolved beta	6.0	0.00	2.5	0.0
Solid beta	9.6	0.00	9.6	0.0

WATER QUALITY VARIATIONS



NAVARRO RIVER NEAR NAVARRO (STA. NO. 8b)

GUALALA RIVER, SOUTH FORK NEAR ANNAPOLIS (STA. 9a)

Sampling Point. Station 9a is located in Section 21 of Township 10 North, Range 14 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the USGS gage, 1,000 feet downstream from Wheatfield Fork Gualala River, 4.8 miles west of Annapolis, and about 8 miles upstream from the mouth.

Period of Record. January 1959 through December 1961.

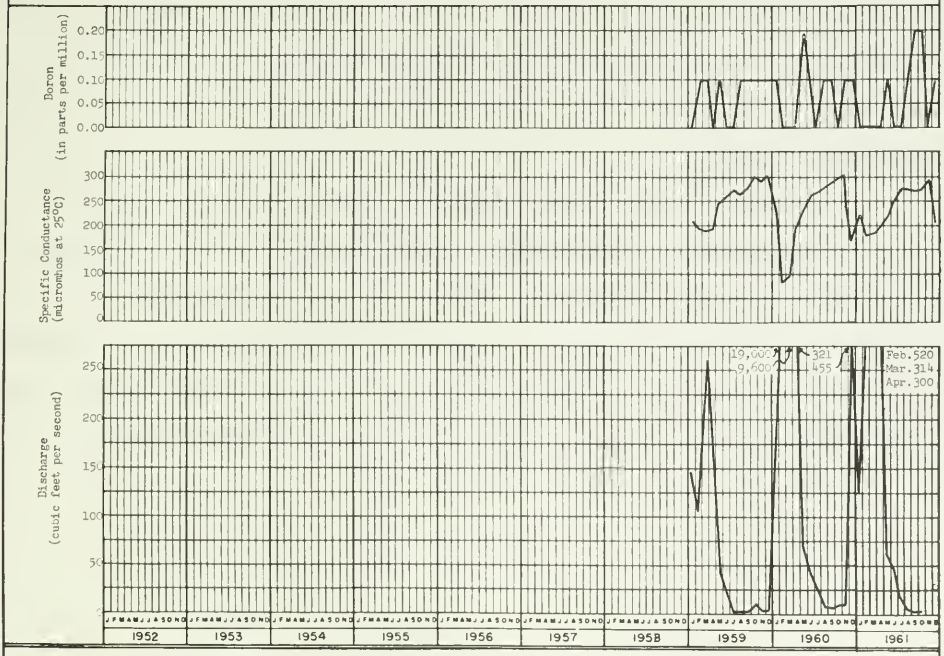
Water Quality Characteristics. The water is calcium-magnesium bicarbonate in character, is slightly to moderately hard, and exhibits high turbidity during peak flow. The water is class 1 for irrigation and concentrations of mineral constituents included in the analyses indicate that it is within drinking water standards.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	302	77.3	290	176
Temperature in °F	72	45	72	45
Dissolved oxygen in parts per million	14.2	7.3	11.3	7.3
Percent saturation	161	75	127	75
pH	8.1	7.0	8.1	7.2
Mineral constituents in parts per million				
Calcium (Ca)	32	18	28	24
Magnesium (Mg)	15	7.8	11	10
Sodium (Na)	17	3.6	15	5.8
Potassium (K)	3.0	0.9	1.4	1.3
Carbonate (CO_3)	6	0.0	2.0	0.0
Bicarbonate (HCO_3)	170	36	156	87
Sulfate (SO_4)	19	7.0	13	12
Chloride (Cl)	14	4.8	13	4.8
Nitrate (NO_3)	1.2	0.0	1.0	0.2
Fluoride (F)	0.1	0.0	0.1	0.0
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	18	14	18	17
Total dissolved solids in parts per million	199	46	174	106
Percent sodium	23	13	22	13
Hardness as $CaCO_3$ in parts per million				
Total	140	31	123	72
Noncarbonate	12.0	0.0	5	0
Turbidity	3,000	0.3	30	1
Coliform in most probable number per milliliter	230.	<0.045	23.	0.5
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.51	0.00	0.08	0.00
Solid alpha	0.63	0.00	0.17	0.09
Dissolved beta	7.60	0.00	5.7	1.9
Solid beta	4.37	0.00	3.8	0.0

WATER QUALITY VARIATIONS



GUALALA RIVER, SOUTH FORK NEAR ANNAPOLIS (STA. NO. 9a)

Russian River Basin

The Russian River Basin lies in the southern end of the North Coastal Region (No. 1) and covers about 1,500 square miles of which approximately 1,200 are mountains and foothills and the remainder valley and mesa lands. The watershed is bounded on the east by the Cow Mountain Range and on the west by the Coastal Range. Waters draining from the watershed flow into the Pacific Ocean at Jenner, approximately 15 miles downstream from Guerneville. The Russian River has a mean annual discharge of approximately 1,500,000 acre-feet. Approximately 180,000 acre-feet of Main Stem Eel River water annually is withdrawn from Lake Pillsbury, passed through the Potter Valley Powerhouse for power generation, and discharged into the Russian River watershed.

The most prominent uses of surface waters in this basin are recreational and industrial. The Russian River valley area contains a large number of recreational facilities for boating, swimming, and fishing. Logging and lumber operations and food processing comprise the major industrial uses of water. Approximately 300 square miles of the Russian River drainage basin are potential agricultural lands.

Most water users in the Russian River Basin discharge waste to the river in quantities less than 0.5 mgd (million gallons per day). Three users, the Masonite Corporation, the City of Ukiah, and the City of Santa Rosa, discharge wastes in quantities over 0.5 mgd to the Russian River or its tributaries. During the 11-year period of quality record on the Russian River, none of these waste discharges have seriously impaired the quality of surface waters.

The following tabulation lists the stations maintained to monitor quality of surface water in this basin and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Russian River near Hopland	78
Russian River near Healdsburg	80
Russian River at Guerneville	82
Russian River, East Fork at Potter Valley Powerhouse	84

RUSSIAN RIVER NEAR HOPLAND (STA. 8a)

Sampling Point. Station 8a is located in Section 36 of Township 14 North, Range 12 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at Largo Road bridge site, 0.6 mile east of Highway 101, and 3.8 miles north of Hopland.

Period of Record. April 1951 through December 1961.

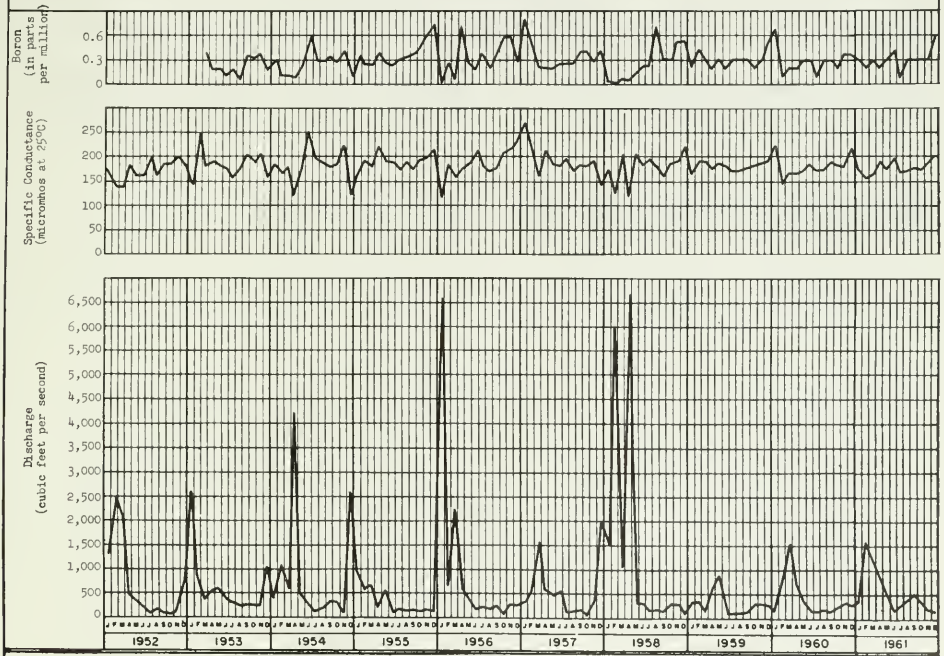
Water Quality Characteristics. Analyses show Russian River at Station 8a to be generally calcium-magnesium bicarbonate in character, soft to moderately hard, and chemically suitable for drinking water. The quality of water at Station 8a does not differ significantly from the quality at Potter Valley Powerhouse (Station 10a). Boron frequently causes the water at Station 8a to be class 2 for irrigation. Highly mineralized spring runoff and solution of minerals from geologic formations in tributary streams are the source of the boron in this river.

Significant Water Quality Changes. The water was class 1 for irrigation during all months of 1960 and 1961 except in January 1960 and December 1961. During these months the boron concentrations of 0.7 ppm and 0.6 ppm, respectively, placed the water in class 2 for irrigation.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	274	120	201	157
Temperature in °F	84	42	72	48
Dissolved oxygen in parts per million	14.0	7.0	11.5	7.8
Percent saturation	150	68	106	70
pH	8.4	6.4	7.7	7.3
Mineral constituents in parts per million				
Calcium (Ca)	27	11	20	18
Magnesium (Mg)	14	5.5	7.8	6.8
Sodium (Na)	14	4.3	9.2	5.2
Potassium (K)	2.0	0.5	1.4	0.9
Carbonate (CO_3)	13	0.0	0.0	0.0
Bicarbonate (HCO_3)	142	62	112	76
Sulfate (SO_4)	11	1.0	8.6	8.0
Chloride (Cl)	10.0	1.2	5.5	1.5
Nitrate (NO_3)	1.8	0.3	1.3	0.6
Fluoride (F)	0.3	0.0	0.2	0.0
Boron (B)	0.80	0.0	0.6	0.1
Silica (SiO_2)	17	7.3	12	9.3
Total dissolved solids in parts per million	161	71	119	93
Percent sodium	34	10	20	13
Hardness as $CaCO_3$ in parts per million				
Total	116	52	93	69
Noncarbonate	12	0.0	7	0
Turbidity	600	0.0	40	2
Coliform in most probable number per milliliter	>7,000	< 0.045	2,400.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.22	0.00	0.30	0.00
Solid alpha	0.59	0.00	0.45	0.00
Dissolved beta	13.91	0.00	3.4	0.1
Solid beta	14.01	0.00	9.2	1.5

WATER QUALITY VARIATIONS



RUSSIAN RIVER NEAR HOPLAND (STA. NO. 8a)

RUSSIAN RIVER NEAR HEALDSBURG (STA. 9)

Sampling Point. Healdsburg station is located in Section 22 of Township 9 North, Range 9 West, Mt. Diablo Base and Meridian. Monthly water samples were collected from the left bank at the USGS gage, 2 miles east of Healdsburg and 3.5 miles upstream from Dry Creek.

Period of Record. April 1951 through December 1961.

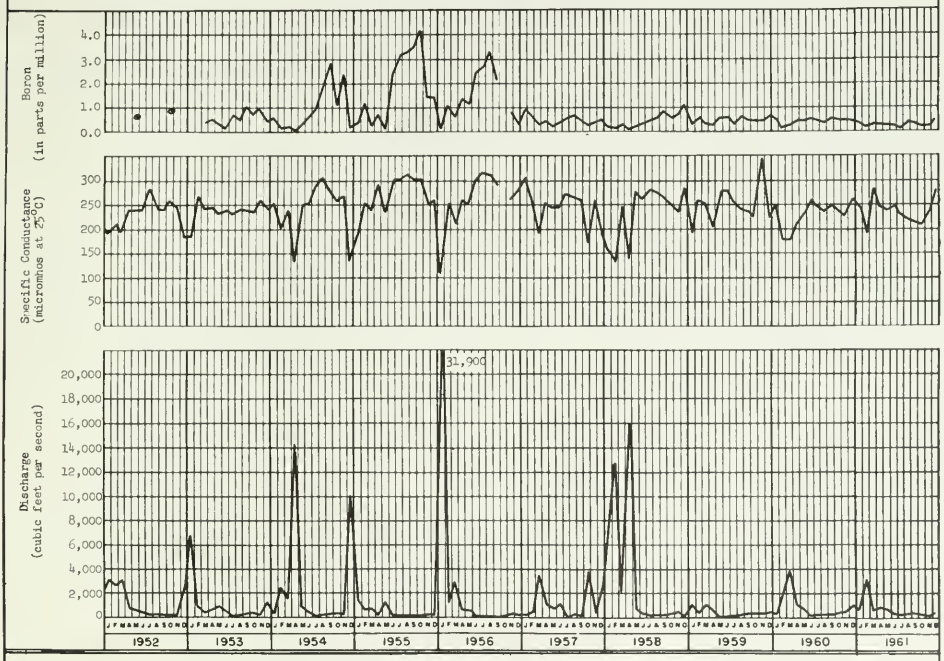
Water Quality Characteristics. Russian River water at Station 9 is, with the exception of boron, good to excellent in quality, calcium bicarbonate to magnesium bicarbonate in character, ranges from soft to moderately hard and meets drinking water standards for mineral content. Prior to 1956, boron concentrations often exceeded the limit for class 1, and at times class 2, irrigation water. The major source of excess boron was detected to be an indistrial discharge, which was discontinued in September 1956. Following its removal, boron concentrations have remained below 1.0 ppm. Dissolved minerals are found in slightly higher concentrations at Station 9 than at the upstream Station 8a.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	344	108	280	193
Temperature in °F	80	45	75	47
Dissolved oxygen in parts per million	13.2	7.0	11.9	7.7
Percent saturation	119	70	109	84
pH	8.6	6.3	8.1	7.4
Mineral constituents in parts per million				
Calcium (Ca)	31	10	24	23
Magnesium (Mg)	16	5.1	12	9.2
Sodium (Na)	19	3.2	9.5	5.6
Potassium (K)	3.2	0.8	1.4	1.0
Carbonate (CO_3)	6	0.0	2.0	0.0
Bicarbonate (HCO_3)	179	58	148	102
Sulfate (SO_4)	14	2.9	11	7.0
Chloride (Cl)	14	1.5	6.8	2.2
Nitrate (NO_3)	1.6	0.0	0.8	
Fluoride (F)	0.3	0.0	0.2	0.1
Boron (B)	4.3	0.06	0.5	0.2
Silica (SiO_2)	98	5.6	13	12
Total dissolved solids in parts per million	204	64	165	114
Percent sodium	36	11	16	12
Hardness as $CaCO_3$ in parts per million				
Total	142	46	132	88
Noncarbonate	16	0.0	11	0
Turbidity	1,000	0.0	500 *	2
Coliform in most probable number per milliliter	>7,000.	0.06	2,400.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.93	0.00	0.17	0.08
Solid alpha	0.91	0.00	0.91	0.25
Dissolved beta	33.36	0.00	3.0	0.0
Solid beta	13.22	0.00	7.1	5.0

WATER QUALITY VARIATIONS



RUSSIAN RIVER NEAR HEALDSBURG (STA. NO. 9)

RUSSIAN RIVER AT GUERNEVILLE (STA. 10)

Sampling Point. Station 10 is located in Section 32 of Township 8 North, Range 10 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at the State Highway 12 bridge in Guerneville, and about 13 miles upstream from the mouth.

Period of Record. April 1951 through December 1961.

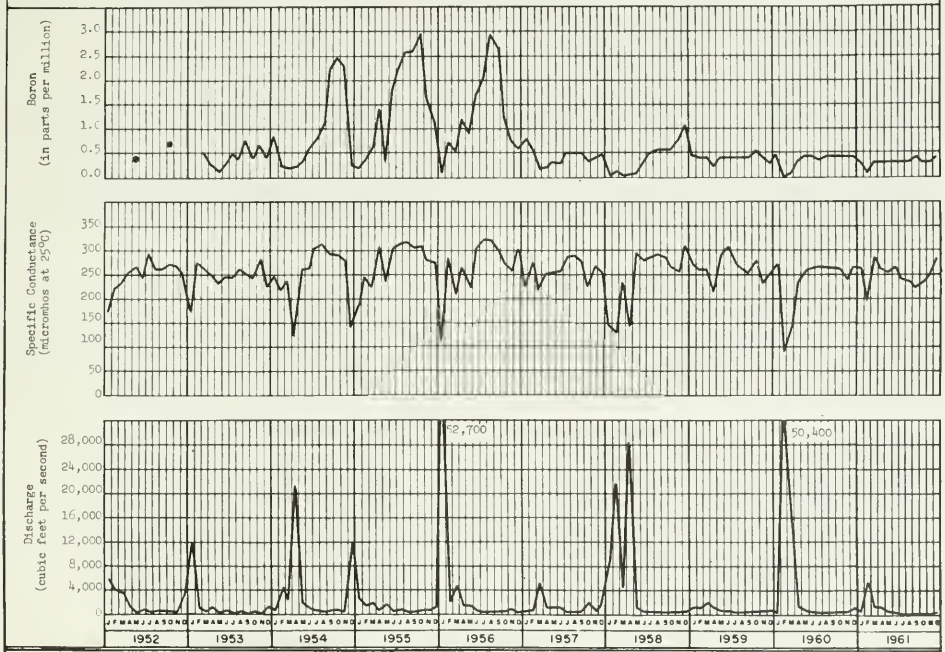
Water Quality Characteristics. Water at Station 10 is calcium-magnesium bicarbonate in character, soft to very hard, and within drinking water standards for mineral content. As at all stations in the Russian River Basin, boron concentrations have often been in excess of class 1 irrigation limits. Prior to 1957, boron was frequently found in excess of class 2 irrigation requirements. After the source of excess boron mentioned in the discussion of Station 9 was removed in September 1956, boron concentrations decreased significantly. Boron has not been detected in excess of 0.5 ppm since 1958, as contrasted to the maximum of 3.0 ppm reported in October 1955.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	381	85.8	281	193
Temperature in °F	80	44	76	46
Dissolved oxygen in parts per million	15.4	1.4	11.2	8.2
Percent saturation	132	14	107	81
pH	8.6	6.4	8.1	7.3
Mineral constituents in parts per million				
Calcium (Ca)	35	10	24	23
Magnesium (Mg)	18	4.9	13	11
Sodium (Na)	16	2.9	13	6.5
Potassium (K)	2.6	0.9	2.5	1.1
Carbonate (CO_3)	6	0.0	0.0	0.0
Bicarbonate (HCO_3)	184	41	146	96
Sulfate (SO_4)	14	5.8	14	8.0
Chloride (Cl)	13	1.0	8.0	2.5
Nitrate (NO_3)	1.5	0.0	1.1	0.7
Fluoride (F)	0.3	0.0	0.1	
Boron (B)	3.0	0.0	0.4	0.1
Silica (SiO_2)	20	9.4	14	13
Total dissolved solids in parts per million	226	51	167	115
Percent sodium	23	11	20	13
Hardness as $CaCO_3$ in parts per million				
Total	232	40	127	81
Noncarbonate	61	0.0	10	0
Turbidity	2,800	0.0	40	2
Coliform in most probable number per milliliter	7,000.	0.045	7,000.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.81	0.00	0.17	0.00
Solid alpha	2.01	0.00	0.22	0.17
Dissolved beta	23.27	0.00	5.7	0.0
Solid beta	9.4	0.00	9.4	2.1

WATER QUALITY VARIATIONS



RUSSIAN RIVER AT GUERNEVILLE (STA. NO. 10)

RUSSIAN RIVER, EAST FORK AT POTTER VALLEY POWERHOUSE (STA. 10a)

Sampling Point. Station 10a is located in Section 6 of Township 17 North, Range 11 West, Mt. Diablo Base and Meridian. Monthly water samples for quality analyses were collected from the tailrace of the PG&E powerhouse, three miles northeast of the town of Potter Valley.

Period of Record. June 1951 through December 1961.

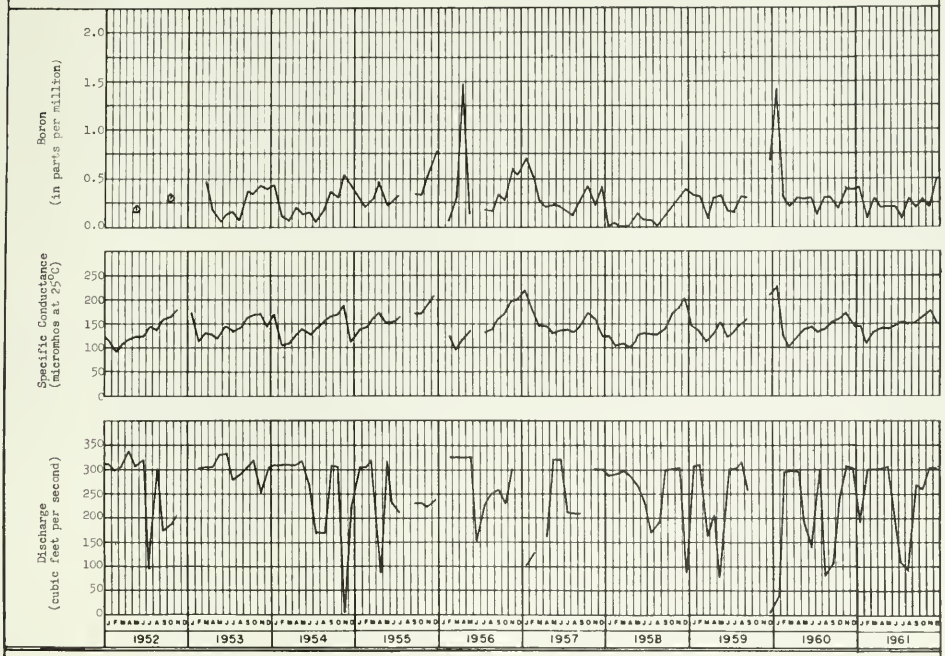
Water Quality Characteristics. Water at Station 10a is calcium bicarbonate in character, soft to moderately hard and within drinking water standards for mineral content. As at Station 8a, boron frequently causes the water to be class 2 for irrigation use. Water at this station is comprised of water exported from the Main Stem Eel River Basin. Boron in waters at this station originates in geologic formations and mineralized springs along the upper reaches of Main Stem Eel River.

Significant Water Quality Changes. During 1960 and 1961, boron exceeded the upper limit for class 1 irrigation water only once. A value of 1.4 ppm was recorded in December 1961 which caused the water to be class 2 for irrigation.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	232	95	177	108
Temperature in °F	76	38	68	41
Dissolved oxygen in parts per million	13.8	7.2	11.5	8.2
Percent saturation	115	81	101	89
pH	8.8	6.4	7.9	7.2
Mineral constituents in parts per million				
Calcium (Ca)	29	12	19	16
Magnesium (Mg)	12.0	3.2	5.0	4.9
Sodium (Na)	12	2.7	5.8	4.0
Potassium (K)	1.6	0.3	0.9	0.7
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	129	46	99	54
Sulfate (SO_4)	8.4	3.8	7.0	5.8
Chloride (Cl)	9.0	0.0	5.2	0.7
Nitrate (NO_3)	0.5	0.0	0.5	0.0
Fluoride (F)	0.2	0.0	0.2	0.0
Boron (B)	1.5	0.0	0.5	0.1
Silica (SiO_2)	15	6.5	10	
Total dissolved solids in parts per million	139	57	106	65
Percent sodium	21	6	15	12
Hardness as $CaCO_3$ in parts per million				
Total	102	42	80	49
Noncarbonate	11	0.0	6.0	0
Turbidity	500	0.0	40	2
Coliform in most probable number per milliliter	>7,000	<0.045	23.	0.13
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.18	0.00	0.08	0.00
Solid alpha	1.6	0.00	0.48	0.00
Dissolved beta	21.11	0.00	8.2	0.0
Solid beta	34.23	0.00	12.2	3.0

WATER QUALITY VARIATIONS



RUSSIAN RIVER, EAST FORK AT POTTER VALLEY POWERHOUSE (STA. NO. 10a)

San Francisco Bay Region (No. 2)

One of the most highly industrialized regions of California is encompassed by the boundaries of the San Francisco Bay Region. The region contains approximately 4,400 square miles in the north central coastal portion of California and includes the industrial and municipal complexes of the City of San Francisco, the Peninsula, San Jose, and the East Bay communities.

Prominent among the physical features of the region is the outstanding natural harbor consisting of San Francisco Bay, San Pablo Bay, and that portion of Suisun Bay below Antioch. This harbor is the focal point of numerous valley basins drained by the watercourses tributary to the bay. These valleys are interspersed and parallel the mountains and foothills of the Coast Range, which rise from sea level to elevations of over 4,000 feet and cover two-thirds of the bay region.

Estimated mean annual surface runoff is 1,245,000 acre-feet in this region. To maintain a surveillance on quality of surface runoff in this area, five monitoring stations are maintained on five streams. The monitored streams are Napa River, Alameda Creek, Arroyo del Valle, Coyote Creek and Los Gatos Creek.

Analyses of samples collected from streams in the San Francisco Bay Region indicate bicarbonate type waters with generally no predominant cation. Although precipitation during 1960 and 1961 was generally below normal in this region, only minor changes in quality were detected.

Napa River Basin

Napa River drains a watershed area of 426 square miles located at the north end of San Francisco Bay Region. The river flows southward through Napa Valley and discharges into San Pablo Bay. Average annual discharge of Napa River is estimated to be 186,300 acre-feet.

Napa River Basin includes approximately 157 square miles of fertile valley and mesa land. Agricultural pursuits are the major users of water and are the dominant economic enterprises of the basin. However, industrial and urban development has accelerated rapidly in the last decade and these are playing a proportionately larger role in the economy of the valley.

Numerous wastes from individual domestic, industrial and agricultural sources, and several community collection systems discharge into Napa River. None of these waste discharges individually exceed 0.3 mgd, except for the Napa County Sanitation District discharge of 4.1 mgd. The latter, however, is tributary to the tidal reach of the river.

A surface water sampling station is maintained on Napa River near St. Helena to monitor quality of runoff from this basin.

NAPA RIVER NEAR ST. HELENA (STA. 72)

Sampling Point. Station 72 is located in Section 32 of Township 8 North, Range 5 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at the center of the stream, from the highway bridge 0.2 mile downstream from the USGS water stage recorder. This gage is located 1.0 mile east of Highway 128 and 2.5 miles southeast of St. Helena.

Period of Record. December 1951 through December 1961.

Water Quality Characteristics. Chemical classification of past analyses show Napa River, at this station, to vary in character from calcium-bicarbonate to calcium-sodium bicarbonate. Flow past Station 72 has met the cirteria for class 1 irrigation supply, except for boron which generally ranges from 0.1 ppm to 1.0 ppm. Boron in waters entering Napa River is probably derived from the geologic formations comprising the earth's mantle in this watershed. Hardness ranges from soft to moderately hard and concentrations of minerals in this water are within the limits for drinking water.

Significant Water Quality Changes. The boron content reached a record high for this station in October 1960. The value recorded was 1.9 ppm. For three consecutive months in 1961 (September, October, November), dissolved oxygen at this station dropped below 5 ppm (the minimum concentration recommended for maintenance of fresh water fish life). A minimum value record of 0.7 ppm was recorded in October 1961.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	499	108	379	162
Temperature in °F	80	41	73	41
Dissolved oxygen in parts per million	15.0	0.7	9.9	0.7
Percent saturation	175	60	108	7.3
pH	8.2	6.8	7.3	6.8
Mineral constituants in parts per million				
Calcium (Ca)	38	11	32	19
Magnesium (Mg)	19	4.9	18	11
Sodium (Na)	36	6.6	26	11
Potassium (K)	8.3	1.8	2.7	2.4
Carbonate (CO_3)	26	0.0	0.0	0.0
Bicarbonate (HCO_3)	210	44	200	62
Sulfate (SO_4)	44	4	18	16
Chloride (Cl)	67	5.0	31	9.0
Nitrate (NO_3)	6.2	0.1	3.4	0.1
Fluoride (F)	0.5	0.1	0.4	0.0
Boron (B)	1.9	0.05	0.9	0.1
Silica (SiO_2)	44	14	43	29
Total dissolved solids in parts per million	333	71	253	108
Percent sodium	44	15	40	20
Hardness as $CaCO_3$ in parts per million				
Total	182	37	161	56
Noncarbonate	55	0.0	17	0
Turbidity	70	0.0	23	0.5
Coliform in most probable number per milliliter	24,000.	< 0.045	7,000.+	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.48	0.00	0.07	0.00
Solid alpha	0.48	0.00	0.15	0.00
Dissolved beta	17.4	0.00	9.5	2.0
Solid beta	10.3	0.00	10.3	3.0

WATER QUALITY VARIATIONS

NAPA RIVER NEAR SAINT HELENA (STA. NO. 72)

Alameda Creek Basin

Alameda Creek watershed is located east of and drains into the southern arm of San Francisco Bay. The drainage basin encompasses about 654 square miles consisting largely of mountains and foothills of the Diablo Range. Livermore Valley is the principal valley area. Mean seasonal natural runoff for Alameda Creek Basin is about 130,700 acre-feet. There are numerous water supply developments in this watershed which greatly affect the runoff characteristics of Alameda Creek.

Agricultural development is still significant in the valley areas of the basin; however, urban, industrial, and commercial growth has been given considerable impetus by the expanding East Bay economy. Surface water in the basin is insufficient to meet present demands, and additional imported water supplies will be needed to sustain the present rate of growth.

Numerous waste discharges, originating from industrial and municipal developments, are discharged into the Alameda Creek watershed waterways. Major waste discharges in this watershed which are located above the most downstream monitoring station and their daily outflows are:

City of Livermore	1.0 mgd
City of Pleasanton	0.6 mgd
Parks Air Force Base	0.5 mgd
Rickenbacker Dairy	0.32 - 1.29 mgd

The following tabulation lists the stations maintained to monitor quality of surface water in this basin and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Alameda Creek near Niles	94
Arroyo del Valle at V. A. Hospital	96

ALAMEDA CREEK NEAR NILES (STA. 73)

Sampling Point. The sampling point for this station is located in Section 15, Township 4 South, Range 1 West, Mt. Diablo Base and Meridian. Daily composite and monthly water samples were collected at the right bank at the concrete control structure of the USGS gaging station located 0.2 mile downstream from the railroad bridge and 1.2 miles northeast of Niles.

Period of Record. December 1951 through December 1961. The stream is dry a portion of each year; consequently, data are not available for all months.

Water Quality Characteristics. Since the inception of a monitoring station on this stream the water has been bicarbonate in character with none of the major cations of calcium, magnesium, or sodium being predominant. Fluctuation in concentrations of total dissolved solids, boron or both, causes the water to range from class 1 to class 2 for irrigation. The water is moderately hard to very hard, and analyses indicate that it is chemically suitable for drinking.

Significant Water Quality Changes. Except in September 1960, boron exceeded 0.5 ppm during 1960 and 1961 placing the water in class 2 for irrigation.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	1,[illegible]	246	1,040	891
Temperature in °F	76	41	67	47
Dissolved oxygen in parts per million	17.0	6.3	12.7	8.9
Percent saturation	158	54	112	96
pH	8.6	7.0	8.1	7.7
Mineral constituents in parts per million				
Calcium (Ca)	96	5.7	60	
Magnesium (Mg)	79	12	51	
Sodium (Na)	136	14	74	24
Potassium (K)	18	1.7	9.0	
Carbonate (CO_3)	23	0.0	2.0	0.0
Bicarbonate (HCO_3)	479	110	334	301
Sulfate (SO_4)	222	33	147	
Chloride (Cl)	210	9	91	60
Nitrate (NO_3)	23.0	0.0	0.6	
Fluoride (F)	0.5	0.0	0.3	
Boron (B)	1.80	0.21	1.0	0.7
Silica (SiO_2)	21	2.9	1.8	
Total dissolved solids in parts per million	915	150	634	544
Percent sodium	40	12	31	12
Hardness as $CaCO_3$ in parts per million				
Total	474	56	395	351
Noncarbonate	366	5	141	94
Turbidity	550	0.3	10	1
Coliform in most probable number per milliliter	24,000.	0.2	6.2	0.2
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.65	0.00	0.65	
Solid alpha	2.82	0.00	0.24	
Dissolved beta	13.47	0.00	0.6	
Solid bete	12.44	0.00	12.3	

WATER QUALITY VARIATIONS

ALAMEDA CREEK NEAR NILES (STA. NO. 73)

ARROYO DEL VALLE AT VETERANS ADMINISTRATION HOSPITAL (STA. 71)

Sampling Point. The location of this station is Section 4, Township 4 South, Range 2 East, Mt. Diablo Base and Meridian. Daily composite and monthly grab samples were collected from the right bank at the USGS gage, adjacent to Arroyo Road. The gage is located immediately upstream from the Veterans Administration Hospital bridge, approximately 4.5 miles south of Livermore.

Period of Record. July 1958 through December 1961. Arroyo del Valle is dry during a portion of each year and water quality data are not available for all months.

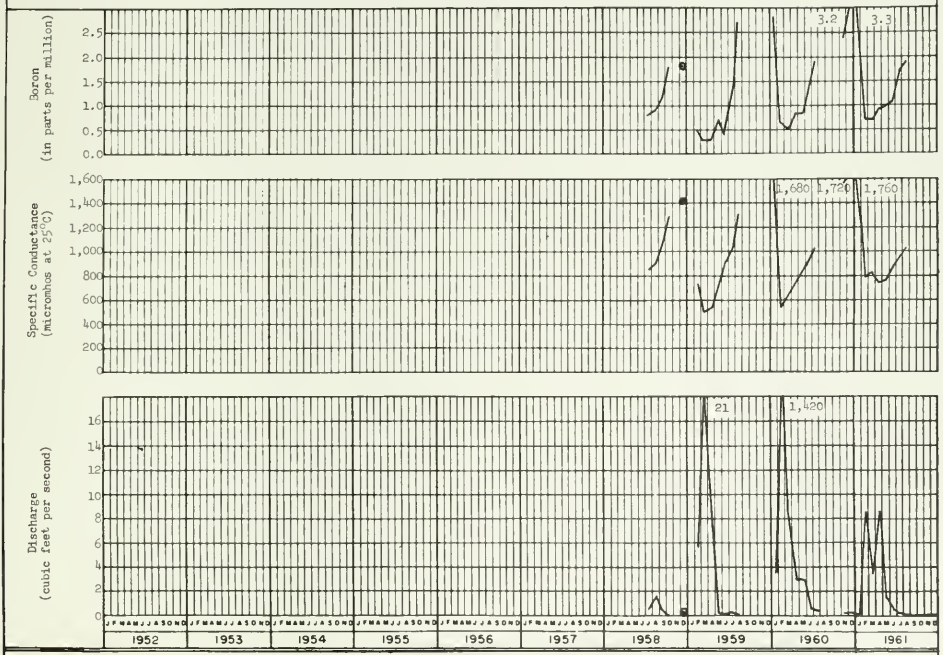
Water Quality Characteristics. A review of the analyses show that this water consistently contains a predominance of bicarbonate anions. The major cations, calcium, magnesium, and sodium, are approximately equal in significance. This water met class 2 irrigation requirements except during August 1959, January and December of 1960, and January 1961 when the boron content exceeded 2.0 ppm. Hardness varies from moderately hard to very hard. Concentrations of mineral constituents included in the analyses are within the limits for drinking water.

Significant Water Quality Changes. Maximum values of record for specific conductance (1760 micromhos) and boron (3.3 ppm) were established in January 1961.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,760	258	1,760	744
Temperature in °F	84	45	82	45
Dissolved oxygen in parts per million	12.4	4.1	12.4	4.5
Percent saturation	159	41	159	53
pH	8.1	7.3	8.1	7.3
Mineral constituents in parts per million				
Calcium (Ca)	115	20	68	
Magnesium (Mg)	80	12	38	
Sodium (Na)	167	8.9	159	15
Potassium (K)	8.6	1.7	3.1	
Carbonate (CO_3)	12	0.0	8.0	0.0
Bicarbonate (HCO_3)	490	116	490	308
Sulfate (SO_4)	236	25	96	
Chloride (Cl)	238	15	208	34
Nitrate (NO_3)	3.5	0.0	1.0	
Fluoride (F)	0.4	0.0	0.2	
Boron (B)	3.3	0.3	3.3	0.7
Silica (SiO_2)	48	13	18	
Total dissolved solids in parts per million	1,085	172	1,085	458
Percent sodium	43	9	36	9
Hardness as $CaCO_3$ in parts per million				
Total	605	116	605	308
Noncarbonate	213	0.0	203	41
Turbidity	25	0.6	6	0.6
Coliform in most probable number per milliliter				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.52	0.00	0.00	
Solid alpha	0.62	0.00	0.60	
Dissolved beta	6.18	0.00	0.0	
Solid beta	8.3	0.00	8.3	

WATER QUALITY VARIATIONS



ARROYO DEL VALLE AT VETERANS HOSPITAL (STA. NO. 71)

Coyote Creek Basin

Coyote Creek originates in the Diablo Range in the southeast corner of the San Francisco Region. It flows northeasterly through a portion of Santa Clara Valley and discharges into San Francisco Bay. Coyote Creek Basin drains 404 square miles of which approximately one-fourth is valley and mesa lands. The creek has a mean annual discharge of about 89,000 acre-feet.

Land use in the valley areas of this basin is devoted to intensive agricultural production. There has been considerable recent industrial development in the vicinities of San Jose and Milpitas, accompanied by a large population growth. Several minor waste discharges are tributary to Coyote Creek, however, they are tributary below the sampling station maintained at Madrone.

COYOTE CREEK NEAR MADRONE (STA. 82)

Sampling Point. The station is located in Section 9, Township 9 South, Range 3 East, Mt. Diablo Base and Meridian, and lies in the northwest corner of the San Jose Grant. Monthly water samples were obtained from the right bank at the USGS gaging station, 0.2 mile downstream from the county road bridge, 2.8 miles northeast of Madrone.

Period of Record. January 1952 through December 1961.

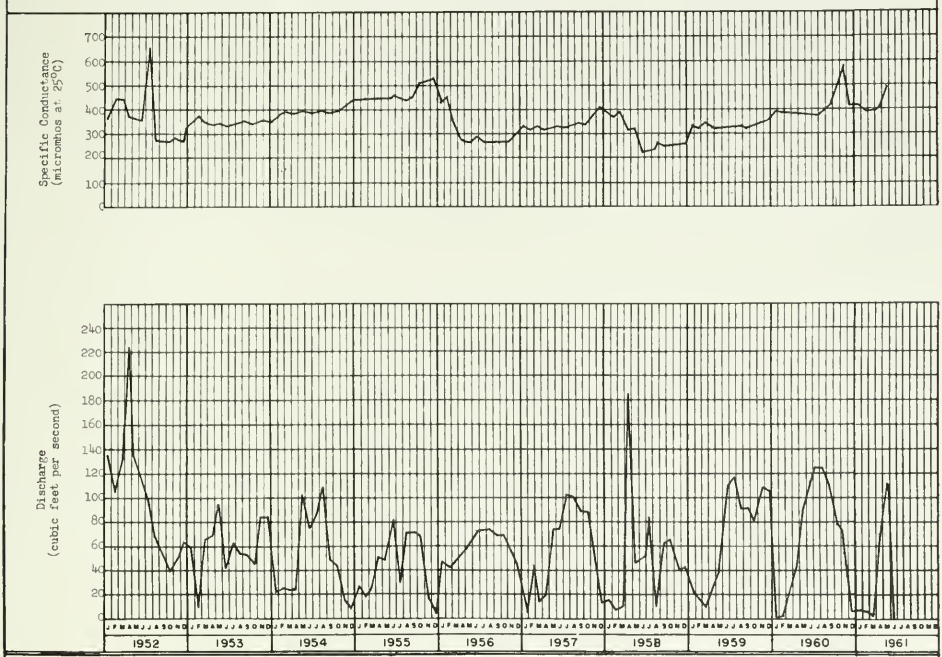
Water Quality Characteristics. Water in Coyote Creek is calcium-magnesium bicarbonate in character, and is class 1 for irrigation. Hardness varies from slightly hard to very hard, and concentrations of mineral constituents included in the analyses are within standards for drinking water.

Significant Water Quality Changes. Coyote Creek at this station was dry during the last seven months of 1961.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	675	227	494	390
Temperature in °F	72	48	62	50
Dissolved oxygen in parts per million	16.0	8.1	13.3	10.4
Percent saturation	154	76	118	93
pH	8.9	7.0	8.3	7.7
Mineral constituents in parts per million				
Calcium (Ca)	57	24	57	
Magnesium (Mg)	26	10	22	
Sodium (Na)	25	10	20	16
Potassium (K)	12	0.8	7.3	
Carbonate (CO_3)	18	0.0	6.0	0.0
Bicarbonate (HCO_3)	340	105	236	174
Sulfate (SO_4)	49	20	49	
Chloride (Cl)	25	5.5	13	10
Nitrate (NO_3)	4.4	0.5	1.1	
Fluoride (F)	0.5	0.0	0.3	
Boron (B)	0.29	0.0	0.2	0.1
Silica (SiO_2)	16	4.5	13	
Total dissolved solids in parts per million	394	133	305	228
Percent sodium	21	12	17	15
Hardness as $CaCO_3$ in parts per million				
Total	322	90	232	168
Noncarbonate	76	0.0	44	20
Turbidity	330	0.0	55	5
Coliform in most probable number per milliliter	>7,000.	<0.045	230.	2.1
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.62	0.00	0.25	
Solid alpha	8.16	0.00	0.41	
Dissolved beta	17.44	0.00	0.2	
Solid beta	11.46	0.00	10.4	

WATER QUALITY VARIATIONS



COYOTE CREEK NEAR MADRONE (STA. NO. 82)

Los Gatos Creek Basin

Los Gatos Creek watershed encompasses approximately 65 square miles in the southwestern portion of the San Francisco Bay Region. Los Gatos Creek originates in the Santa Cruz Mountains and flows northeasterly a distance of about 20 miles to join Guadalupe River at the City of San Jose. Mean seasonal runoff from this basin is about 35,800 acre-feet.

Due to mountainous terrain along the upper reaches of Los Gatos Creek, development is almost exclusively confined to the drainage area tributary to its lower ten-mile reach. Land use is largely urban, interspersed with light industry. Land devoted to agriculture in this watershed has diminished rapidly in the past decade and only scattered orchards and vineyards remain.

Numerous waste discharges enter Los Gatos Creek in minor quantities. There are no waste discharges in excess of 0.5 mgd being disposed of directly into the waterway of Los Gatos Creek.

A surface water monitoring station is maintained on Los Gatos Creek immediately above the community of Los Gatos.

LOS GATOS CREEK AT LOS GATOS (STA. 74)

Sampling Point. Station 74 is located in Section 29, Township 8 South, Range 1 West, Mt. Diablo Base and Meridian. Monthly water samples were collected from the left bank at the USGS gage about 0.75 mile upstream from Los Gatos, approximately 0.25 mile below Lexington Dam. This point is 10.5 miles above the mouth of the creek.

Period of Record. December 1951 through December 1961.

Water Quality Characteristics. A review of analyses reveals that this stream is calcium-magnesium bicarbonate in character. Los Gatos Creek water meets class 1 irrigation requirements. The water ranges from slightly hard to very hard, and concentrations of mineral constituents included in the analyses are within the limits for drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	896	203	849	441
Temperature in °F	77	43	69	48
Dissolved oxygen in parts per million	13.4	7.6	11.8	8.3
Percent saturation	118	78	110	88
pH	8.3	6.8	8.1	7.4
Mineral constituents in parts per million				
Calcium (Ca)	100	18	100	85
Magnesium (Mg)	40	7.7	40	33
Sodium (Na)	34	6.9	33	11
Potassium (K)	3.9	0.8	2.7	2.5
Carbonate (CO_3)	13	0.0	6.0	0.0
Bicarbonate (HCO_3)	428	69	388	126
Sulfate (SO_4)	167	13	167	112
Chloride (Cl)	67	3.6	26	12
Nitrate (NO_3)	4.4	0.0	0.8	0.3
Fluoride (F)	0.4	0.1	0.3	0.1
Boron (B)	0.4	0.0	0.4	0.1
Silica (SiO_2)	38	11	17	14
Total dissolved solids in parts per million	546	124	517	269
Percent sodium	29	6	19	6
Hardness as $CaCO_3$ in parts per million				
Total	471	60	424	191
Noncarbonate	149	0.0	149	40
Turbidity	900	0.4	140	1
Coliform in most probable number per milliliter	77,000.	0.06	2,400.	0.29
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.80	0.00	0.80	0.30
Solid alpha	1.30	0.00	0.38	0.24
Dissolved beta	17.44	0.00	4.6	0.0
Solid beta	18.24	0.00	8.0	7.4

WATER QUALITY VARIATIONS

LOS GATOS CREEK AT LOS GATOS (STA. NO. 74)

Central Coastal Region (No. 3)

The Central Coastal Region contains approximately 11,000 square miles of coastal valleys and mountain ranges. The region extends 220 miles north-south from the southern boundary of Pescadero Creek Basin (about 35 miles south of the City of San Francisco) to the northeastern boundary of Rincon Creek Basin (approximately 70 miles north of Los Angeles).

Valley and mesa areas cover over 2,000 square miles of this region, with the valley fill along Salinas River comprising over 40 percent of these lands. The coastline is rocky and rugged except for a few river deltas. Mountain peaks in excess of 5,000 feet elevation exist in most of the ranges with Sawmill Mountain at the head of Santa Maria River reaching 8,750 feet.

Mean seasonal runoff from this region is 2,447,600 acre-feet. Principal hydrographic units in the Central Coastal Region include the San Lorenzo, Pajaro, Salinas, Carmel, Santa Maria, and Santa Ynez. In the Central Coastal Region (No. 3) 14 sampling stations are being monitored to maintain a surveillance on quality of surface waters. The monitored streams and the number of stations on each (in parentheses) are presented in the following tabulation:

San Lorenzo River (1)
Soquel Creek (1)
Pajaro River (1)
Uvas Creek (1)
San Benito River (1)
Salinas River (3)
Nacimiento River (1)
San Antonio Creek (1)
Carmel River (1)
Cuyama River (1)
Santa Ynez River (2)

The upper reaches of the Salinas River and the Nacimiento, Cuyama, San Antonio, and Santa Ynez Rivers are in Southern California and will be discussed in Volume II of this bulletin.

San Lorenzo River Basin

The San Lorenzo River Basin drains an area of 137 square miles in the northwest corner of the Central Coastal Region. The river flows north to south and discharges into Monterey Bay at the City of Santa Cruz.

The San Lorenzo River watershed is generally mountainous with only seven square miles being identified as valley or mesa lands. Urban and light industrial development are prominent in the Santa Cruz area. Along the upper reaches of the river, recreation, a few lumber mills, and resort facilities support the economy of the area. Mean seasonal runoff in this basin is estimated to be 125,100 acre-feet.

Waste discharges entering San Lorenzo Basin waterways are not of significant quantity. Several gravel wash discharges of about 0.10 mgd constitute the only notable source of possible impairment under present development.

SAN LORENZO RIVER AT BIG TREES NEAR FELTON (STA. 75)

Sampling Point. The sampling point for this station is located in Section 26, Township 10 South, Range 2 West, Mt. Diablo Base and Meridian, Canada del Rincon Grant. Monthly grab samples were collected from the right bank at Sequoia Gardens Resort, 1.7 miles south of Felton and east of State Highway 9.

Period of Record. December 1951 through December 1961.

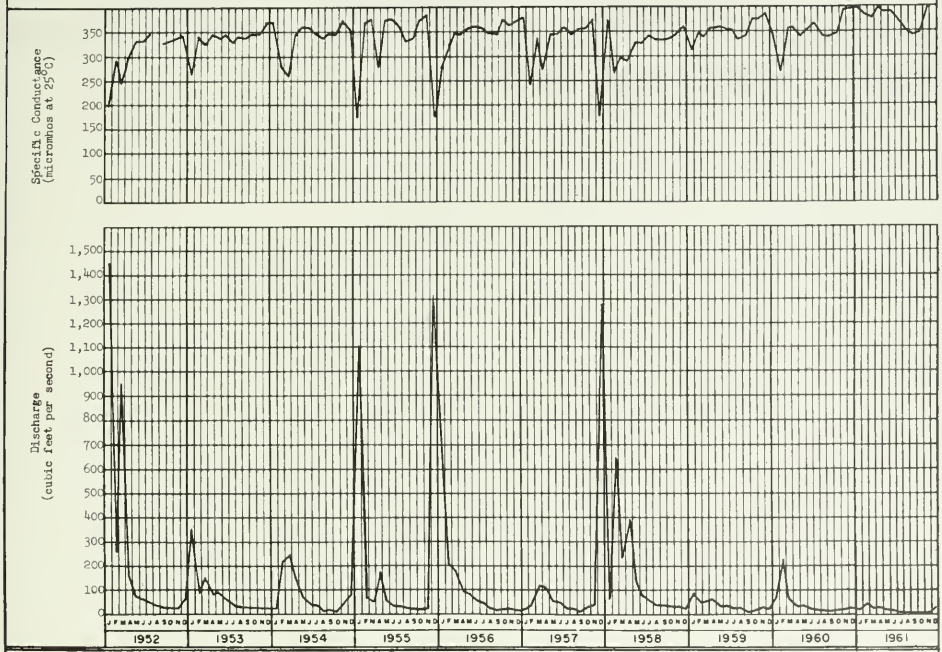
Water Quality Characteristics. Water at this location is calcium bicarbonate in character and slightly to moderately hard. The water is class 1 for irrigation and concentrations of mineral constituents included in the analyses met the criteria for domestic uses. The City of Santa Cruz uses San Lorenzo River water as a source of municipal supply.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	433	168	433	343
Temperature in °F	77	43	75	47
Dissolved oxygen in parts per million	14.1	8.5	13.6	8.8
Percent saturation	130	80	130	87
pH	8.3	6.8	8.3	7.2
Mineral constituents in parts per million				
Calcium (Ca)	44	19	44	38
Magnesium (Mg)	12	1.0	7.8	6.8
Sodium (Na)	33	10	33	21
Potassium (K)	2.7	1.4	1.5	
Carbonate (CO_3)	6	0.0	4.0	0.0
Bicarbonate (HCO_3)	153	48	143	125
Sulfate (SO_4)	51	24	41	30
Chloride (Cl)	34	6.5	34	23
Nitrate (NO_3)	1.0	0.0	1.0	0.5
Fluoride (F)	0.3	0.09	0.2	
Boron (B)	0.3	0.0	0.3	0.0
Silica (SiO_2)	32	20	32	21
Total dissolved solids in parts per million	263	102	263	211
Percent sodium	34	20	34	26
Hardness as $CaCO_3$ in parts per million				
Total	159	59	159	123
Noncarbonate	57	8	57	15
Turbidity	2,400	0.6	10	1
Coliform in most probable number per milliliter	>7,000.	0.19	230.	1.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.70	0.00	0.08	0.00
Solid alpha	1.73	0.00	0.16	0.00
Dissolved beta	15.31	0.00	4.4	1.7
Solid beta	11.1	0.00	11.1	0.0

WATER QUALITY VARIATIONS



SAN LORENZO RIVER AT BIG TREES (STA. NO. 75)

Soquel Creek Basin

Soquel Creek drains an area of 91 square miles immediately east of the San Lorenzo River Basin in the northwest portion of the Central Coastal Region. Soquel Creek watershed has a mean annual runoff of about 63,500 acre-feet. Topography in the creek changes along its entire reach. The river originates in rugged mountains and flows southward through a gradual transition to rolling hills and finally, at the edge of the Pacific Ocean, it traverses a marine terrace.

Development in the basin is primarily concentrated along the marine terrace bordering the lower reaches. Urban, agricultural, and light industrial development combine to sustain the growing population of the area.

Waste discharges from present development are minor and have not created notable impairment problems. A sand and gravel borrow area is located in the streambed upstream from the town of Soquel and occasionally causes considerable turbidity in Soquel Creek.

SOQUEL CREEK AT SOQUEL (STA. 76)

Sampling Point. Soquel Creek is sampled in Section 10, Township 11 South, Range 1 West, Mt. Diablo Base and Meridian. Monthly water samples were collected from the left bank at the USGS gage, which is located 0.25 mile upstream from the bridge on old Santa Cruz Highway and about 1.2 miles from the mouth.

Period of Record. December 1951 through December 1961.

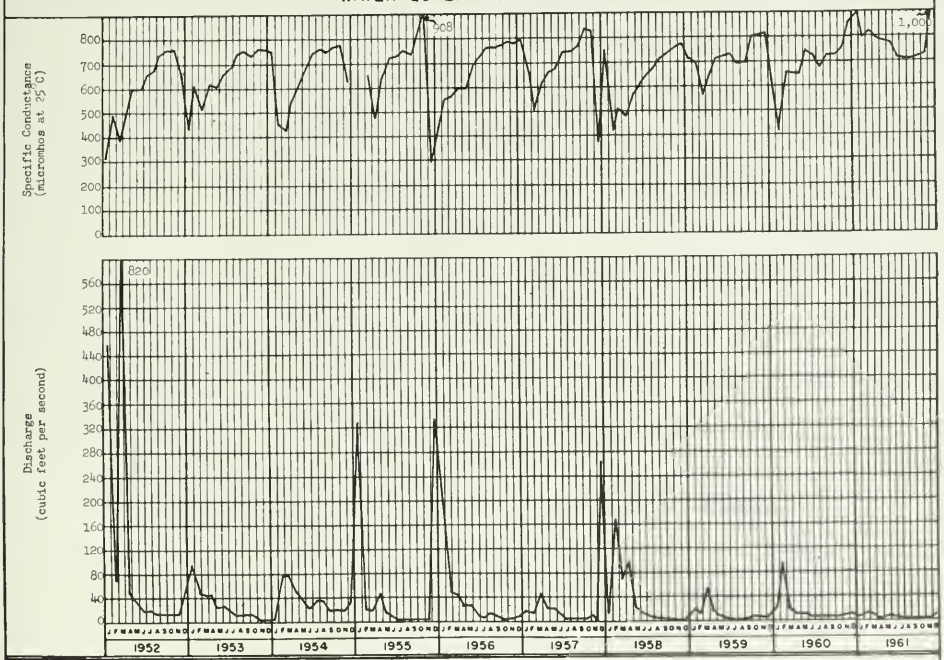
Water Quality Characteristics. Water samples collected at this station are calcium bicarbonate in nature. This water generally qualifies as class 1 for irrigation and a hardness ranging from slightly hard to very hard.

Significant Water Quality Changes. Boron content, which is generally low, reached an unusually high concentration of 2.2 ppm in the month of April 1960 causing the water to be class 3 for irrigation at that time.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,000	278	1,000	706
Temperature in °F	79	45	78	50
Dissolved oxygen in parts per million	13.8	6.3	13.8	6.3
Percent saturation	139	67	139	67
pH	8.4	7.1	8.4	7.5
Minsral constituents in parts per million				
Calcium (Ca)	84	28	79	71
Magnesium (Mg)	35	2.7	24	
Sodium (Na)	73	15	72	42
Potassium (K)	6.8	1.3	4.7	3.9
Carbonate (CO_3)	16	0.0	13	0.0
Bicarbonate (HCO_3)	277	78	255	208
Sulfate (SO_4)	111	75	111	85
Chloride (Cl)	106	1	106	51
Nitrate (NO_3)	0.9	0.0	0.6	0.2
Fluoride (F)	0.5	0.0	0.3	
Boron (B)	0.5	0.0	0.5	0.0
Silica (SiO_2)	40	20	36	29
Total dissolved solids in parts per million	631	175	631	435
Percent sodium	34	20	30	23
Hardness as $CaCO_3$ in parts per million				
Total	370	72	370	276
Noncarbonate	176	0.0	176	78
Turbidity	500	0.0	10	0.9
Coliform in most probable number per milliliter	>7,000.	0.62	500.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.45	0.00	0.24	0.08
Solid alpha	1.04	0.00	0.25	0.00
Dissolved beta	14.1	0.00	4.9	4.6
Solid beta	7.09	0.00	6.3	1.6

WATER QUALITY VARIATIONS



SOQUEL CREEK AT SOQUEL (STA. NO. 76)

Pajaro River Basin

The Pajaro River drainage basin encompasses 1,303 square miles in the northwestern portion of the Central Coastal Region. Llagas Creek, Pacheco Creek, and several other smaller streams combine to form the Pajaro River in the lower end of South Santa Clara Valley. The confluence of the San Benito and Pajaro Rivers is located just east of Pajaro Gap and less than ten miles downstream from Pajaro River formation point. Only 116 square miles of drainage area contribute to the runoff to the Pajaro River below Pajaro Gap. The Pajaro River Basin has an average annual runoff of about 222,500 acre-feet.

Mountains and foothills cover almost 80 percent of the land area in this basin. The three valley fill areas, Pajaro, South Santa Clara, and Hollister, comprise 280 square miles of potential or already developed agricultural lands. Agriculture is the predominant user of water and is the major factor in economic development in the area.

Waste discharges entering waterways of this basin originate from urban, light industrial, and individual domestic sources. Excepting for the waste outflows from the cities of Gilroy (2.75 mgd) and Hollister (0.50 mgd), these discharges do not exceed 0.50 mgd, however, they generally do not contribute to the impairment of the quality of the stream system. Irrigation return flows are the major source of quality impairment in the Pajaro River Basin.

The following tabulation lists the stations maintained to monitor quality of surface water in this basin and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussed
Pajaro River near Chittenden	118
Uvas Creek near Morgan Hill	120
San Benito River near Bear Valley Fire Station	122

PAJARO RIVER NEAR CHITTENDEN (STA. 77)

Sampling Point. Station 77 is located in Section 12, Township 12 South, Range 3 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the bridge crossing on Chittenden Road at the Santa Cruz-San Benito County Line. The sampling point is located 1 mile southeast of Chittenden and 2.5 miles downstream from the San Benito River confluence.

Period of Record. December 1951 through December 1961.

Water Quality Characteristics. Since inception of a monitoring station on Pajaro River analysis of the water reveals bicarbonate to be the predominant anion and calcium, magnesium, and sodium cations to be nearly equal in equivalents per million. The water at this station is generally class 2 for irrigation. In 1954, a boron concentration of 2.0 ppm was found, which is the upper limit for a class 2 water. In 1957 a chloride concentration of 374 ppm made waters from Pajaro River class 3. Pajaro River water also has, on occasion, exceeded the mineral criteria for drinking water and generally ranges from moderately hard to very hard.

Significant Water Quality Changes. During 1960-61, these waters were very hard and, except for February 1960, had salt concentrations higher than those recommended for class 1 irrigation water.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	2,200	268	1,950	1,330
Temperature in °F	77	45	73	45
Dissolved oxygen in parts per million	14.2	3.4	12.8	7.3
Percent saturation	131	28	131	75
pH	8.4	7.3	8.4	7.7
Mineral constituents in parts per million				
Calcium (Ca)	149	28	93	67
Magnesium (Mg)	94	17	70	69
Sodium (Na)	273	29	254	100
Potassium (K)	12	1.7	4.4	3.6
Carbonate (CO_3)	34	0.0	34	0.0
Bicarbonate (HCO_3)	620	122	573	396
Sulfate (SO_4)	304	67	237	169
Chlorids (Cl)	374	8	310	108
Nitrate (NO_3)	15	0.3	3.7	1.3
Fluorids (F)	0.6	0.0	0.3	
Boron (B)	2.0	0.18	1.7	0.6
Silica (SiO_2)	32	8.2	19	16
Total dissolved solids in parts per million	1,400	169	1,230	840
Percent sodium	75	21	57	30
Hardness as $CaCO_3$ in parts per million				
Total	625	106	518	410
Noncarbonate	340	0.0	182	0
Turbidity	1,600	0.4	15	1
Coliform in most probable number per milliliter	▸ 7,000.	0.23	2,400.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.86	0.00	0.16	0.00
Solid alpha	0.61	0.00	0.08	0.00
Dissolved beta	11.73	0.00	10.0	8.6
Solid beta	9.69	0.00	5.5	4.4

WATER QUALITY VARIATIONS

PAJARO RIVER AT CHITTENDEN (STA. NO. 77)

UVAS CREEK NEAR MORGAN HILL (STA. 96)

Sampling Point. Uvas Creek is sampled in Section 18, Township 10 South, Range 3 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected immediately below Uvas Dam at the outlet, about 0.6 mile downstream from Eastman Canyon and 4.8 miles southwest of Morgan Hill.

Period of Record. July 1952 through December 1961.

Water Quality Characteristics. Chemical classification of past analyses of this water revealed a predominant bicarbonate anion and the principal cations to be calcium and magnesium, neither of which is consistently predominant. Uvas Creek water is class 1 for irrigation, meets the drinking water mineral limits, and ranges from slightly hard to very hard. This water is a source of municipal supply for the City of Gilroy.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	466	183	466	372
Temperature in °F	80	45	75	50
Dissolved oxygen in parts per million	13.2	5.6	13.2	7.0
Percent saturation	126	60	118	81
pH	8.3	7.0	8.1	7.5
Mineral constituents in parts per million				
Calcium (Ca)	52	13	45	
Magnesium (Mg)	42	10	21	
Sodium (Na)	41	5.6	16	12
Potassium (K)	3.7	0.6	1.2	
Carbonate (CO_3)	16	0.0	10	0.0
Bicarbonate (HCO_3)	239	95	239	183
Sulfate (SO_4)	44	9.6	40	
Chloride (Cl)	14	3.2	10	7.0
Nitrate (NO_3)	1.6	0.0	0.1	
Fluoride (F)	0.3	0.0	0.3	
Boron (B)	0.27	0.0	0.2	0.1
Silica (SiO_2)	26	12	14	
Total dissolved solids in parts per million	287	113	287	230
Percent sodium	32	9	13	12
Hardness as $CaCO_3$ in parts per million				
Total	227	82	227	174
Noncarbonate	34	0	34	21
Turbidity	140	0.0	15	2
Coliform in most probable number per milliliter	>7,000.	<0.045	62.	0.13
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.90	0.00	0.00	
Solid alpha	0.50	0.00	0.45	
Dissolved beta	6.40	0.00	3.6	
Solid beta	15.5	0.00	15.5	

WATER QUALITY VARIATIONS

UVAS CREEK NEAR MORGAN HILL (STA. NO. 96)

SAN BENITO RIVER NEAR BEAR VALLEY FIRE STATION (STA. 77a)

Sampling Point. The location of this sampling station is in Section 28, Township 15 South, Range 7 East, Mt. Diablo Base and Meridian. Monthly water samples were collected from the left bank about 1.7 miles downstream from Willow Creek, 10.5 miles northwest of San Benito, and 3.0 miles north of Bear Valley Fire Station.

Period of Record. July 1958 through December 1961.

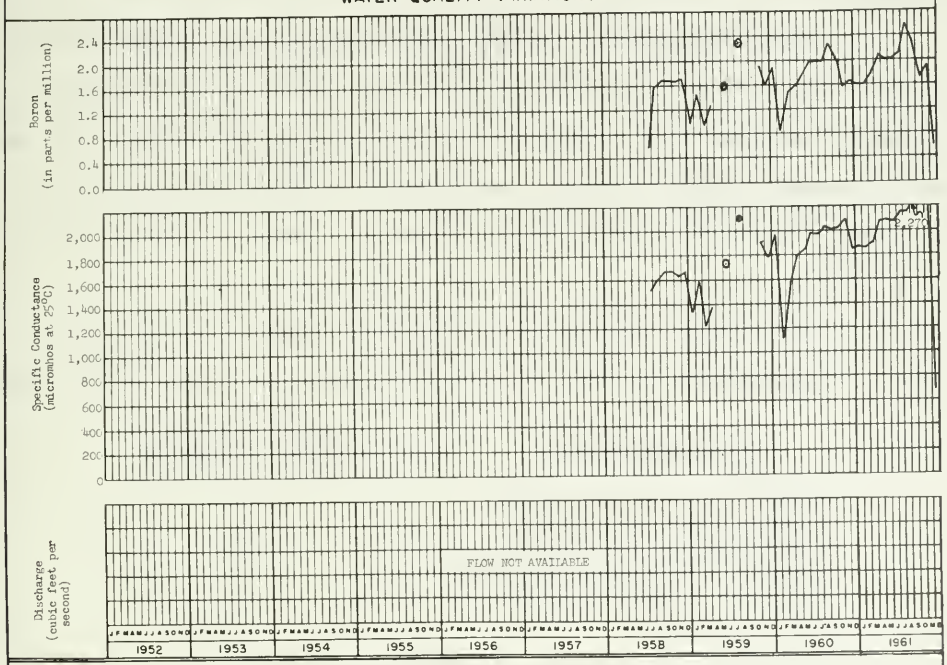
Water Quality Characteristics. Past and present analyses show the principal cations to be magnesium and sodium, and the principal anions to be bicarbonate and sulfate. This water is unsatisfactory for domestic use because of high values of total dissolved solids and sulfates. The water is extremely hard with a range of 298 to 702 ppm total hardness. The water is usually class 2 for irrigation and occasionally class 3 because of excessive boron concentrations.

Significant Water Quality Changes. Boron and hardness concentrations increased during 1960 and 1961. Analyses showed that boron equaled or exceeded 2.0 ppm for five months in 1960 and for six months in 1961 as compared to only one value over 2.0 ppm recorded previous to 1960. Similarly, values for hardness during 1960 and 1961 exceeded those recorded prior to 1960 most of the time.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	2,270	686	2,270	686
Temperature in °F	89	46	89	50
Dissolved oxygen in parts per million	12.6	8.0	11.2	8.4
Percent saturation	142	87	142	87
pH	8.5	7.9	8.5	8.0
Mineral constituents in parts per million				
Calcium (Ca)	63	2.4	50	39
Magnesium (Mg)	147	98	147	130
Sodium (Na)	292	40	282	40
Potassium (K)	7.2	2.7	6.8	3.6
Carbonate (CO_3)	41	0.0	41	0.0
Bicarbonate (HCO_3)	564	310	542	310
Sulfate (SO_4)	484	192	484	475
Chloride (Cl)	215	26	212	26
Nitrate (NO_3)	1.9	0.0	0.6	0.4
Fluoride (F)	0.5	0.1	0.5	0.4
Boron (B)	2.6	0.6	2.6	0.6
Silica (SiO_2)	17	4.0	15	10
Total dissolved solids in parts per million	1,480	445	1,480	445
Percent sodium	52	23	49	23
Hardness as $CaCO_3$ in parts per million				
Total	702	298	702	298
Noncarbonate	233	44	232	44
Turbidity	400	1	70	1
Coliform in most probable number per milliliter	2,400.	0.23	2,400.	1.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.23	0.08	0.08	0.00
Solid alpha	0.38	0.00	0.24	0.00
Dissolved beta	8.84	0.0	5.0	0.0
Solid beta	13.0	0.2	13.0	7.3

WATER QUALITY VARIATIONS



SAN BENITO RIVER NEAR BEAR VALLEY FIRE STATION (STA. NO. 77a)

Salinas River Basin

The Salinas River system drains an area of about 4,400 square miles which cover the central portion of the Central Coastal Region. Mountains and foothills cover approximately 3,880 square miles and valley and mesa land occupy the remaining 520 square miles. From its coast line along the Monterey Bay, the basin extends southeasterly about 150 miles.

The Salinas River meanders along its course through Salinas Valley for nearly 100 miles. The economy of the basin is based on the agricultural complex which has developed on the fertile valley floor. Water requirements of the basin for domestic, municipal, industrial, and irrigation are supplied mostly from ground water. In recent years several small dams on tributaries to the Salinas River have provided surface water supplies to the upper end of the valley.

Waste disposal and irrigation return water have not created serious deleterious effects on the quality of water in the basin. Significant waste discharges entering this stream system are for the most part outflows from community sewerage systems. Prominent among these are Alisal Sanitary District (1.0 mgd), King City (0.5 mgd), City of Salinas (4.1 mgd), and Soledad Prison (0.5 mgd).

The following tabulation lists the stations maintained to monitor quality of surface water in this basin and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussed
Salinas River at Paso Robles	*
Salinas River near Bradley	*
Salinas River near Spreckels	126
Nacimiento River near San Miguel	*
San Antonio River at Pleyto	*

* Monitoring stations are in Southern California and will be discussed in Volume II of this bulletin.

SALINAS RIVER NEAR SPRECKELS (STA. 43)

Sampling Point. Station 43 is located in Section 8, Township 15 South, Range 3 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, at the USGS gaging station 50 yards upstream from the bridge, 4 miles south of Salinas, and 2.0 miles west of Spreckels.

Period of Record. April 1951 through May 1957, and April 1958 through December 1961. Salinas River at this station is sometimes dry and data are not available for all months.

Water Quality Characteristics. Water in this stream can be termed a calcium-magnesium-sodium bicarbonate type that ranges from moderate hardness to very hard. Concentrations of total dissolved solids and fluoride exceed the criteria for domestic use. During most of the year, Salinas River water at this point is class 2 for irrigation. Effluent from Alisal Sanitary District Sewage Treatment Plant is discharged to the river about 100 yards upstream from the sampling station.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,750	307	1,300	968
Temperature in °F	81	44	73	51
Dissolved oxygen in parts per million	12.5	0.3	4.2	0.3
Percent saturation	136	0.0	39	3.2
pH	8.3	6.6	7.3	7.0
Mineral constituents in parts per million				
Calcium (Ca)	152	32	60	33
Magnesium (Mg)	58	13	43	29
Sodium (Na)	176	15	149	114
Potassium (K)	41	1.8	14	
Carbonate (CO_3)	22	0.0	0.0	0.0
Bicarbonate (HCO_3)	910	122	496	192
Sulfate (SO_4)	206	40	105	99
Chloride (Cl)	190	14	162	123
Nitrate (NO_3)	29	0.0	29	1.6
Fluoride (F)	2.4	0.2		
Boron (B)	0.7	0.0	0.6	0.3
Silica (SiO_2)	62	22	50	
Total dissolved solids in parts per million	1,090	180	762	568
Percent sodium	56	19	55	40
Hardness as $CaCO_3$ in parts per million				
Total	650	132	375	202
Noncarbonate	263	0.0	79	0
Turbidity	400	0.0	80	2
Coliform in most probable number per millilitar	62,000.	0.06	2,400.	6.2
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.76	0.00	0.76	0.17
Solid alpha	0.47	0.00	0.25	0.15
Dissolved beta	27.48	0.00	14.1	8.4
Solid beta	12.7	0.00	12.7	0.5

WATER QUALITY VARIATIONS

SALINAS RIVER NEAR SPRECKELS (STA. NO. 43)

Carmel River Basin

In the north-central portion of the Central Coastal Region and immediately south of Monterey Bay lies the Carmel River watershed. The area of this basin is 254 square miles, of which nearly 249 square miles comprise foothills and mountains. The Carmel River Basin has a mean annual discharge of about 142,300 acre-feet.

Development in this area is centered around Carmel Valley and in the widely known resort area on Monterey Peninsula. Irrigated lands in the valley and urban and domestic requirements of the peninsula account for the major water use in the basin.

Wastes in this basin, for the most part, are discharged to the Pacific Ocean. Wastes entering Carmel River are minor in quantity and do not create serious impairment problems.

CARMEL RIVER AT ROBLES DEL RIO (STA. 83)

Sampling Point. Station 83 is located in Section 17, Township 16 South, Range 1 East, Mt. Diablo Base and Meridian. Monthly grab samples were taken from midstream at Robles del Rio bridge in the town of Robles del Rio.

Period of Record. January 1952 through December 1961. Carmel River has been dry on many occasions during this period, therefore, data are not available for all months.

Water Quality Characteristics. Water in this river has no predominant cation, and the principal anions are bicarbonate and sulfate. Hardness ranges from slightly hard to very hard. Concentrations of mineral constituents included in the analyses indicate that the water is suitable for domestic use, and qualifies as class 1 for irrigation.

Significant Water Quality Changes. Specific conductance reached a new maximum of record of 1180 micromhos and chlorides attained a record concentration of 120 ppm.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	1,180	130	844	542
Temperature in °F	78	46	58	48
Dissolved oxygen in parts per million	16.4	5.6	10.4	6.2
Percent saturation	188	56	93	61
pH	8.3	7.0	7.5	7.3
Mineral constituents in parts per million				
Calcium (Ca)	78	20	78	
Magnesium (Mg)	33	5.3	23	
Sodium (Na)	82	11	62	31
Potassium (K)	5.0	1.5	5.0	
Carbonate (CO_3)	3	0.0	0.0	0.0
Bicarbonate (HCO_3)	275	54	228	166
Sulfate (SO_4)	139	36	139	
Chloride (Cl)	120	6	67	36
Nitrate (NO_3)	1.7	0.0	0.0	
Fluoride (F)	0.5	0.0	0.4	
Boron (B)	0.24	0.0	0.1	0.0
Silica (SiO_2)	27	21	21	
Total dissolved solids in parts per million	732	81	523	336
Percent sodium	43	22	33	27
Hardness as $CaCO_3$ in parts per million				
Total	455	44	308	183
Noncerbonate	229	7	121	47
Turbidity	90	0.0	10	1
Coliform in most probable number per milliliter	7,000.	<0.045	23.	0.23
Radioactivity in micro-micro curiee per liter				
Dissolved alpha	2.42	0.00	0.39	
Solid alpha	0.41	0.00	0.08	
Dissolved beta	7.0	0.00	5.2	
Solid beta	9.55	0.00	8.7	

WATER QUALITY VARIATIONS

CARMEL RIVER NEAR ROBLES DEL RIO (STA. NO. 83)

Central Valley Region (No. 5)

The Central Valley Region occupies about one-third of the total area of California and is comprised of all stream basins which drain into the Sacramento and San Joaquin Valleys. The basin extends from the Oregon-California border in the northeastern corner of the State to the crest of the Tehachapi Mountains 60 miles north of the City of Los Angeles. In order to facilitate discussion of this region, it is subdivided into four separate areas as listed below:

Name of Areas	Numerical Designation
Sacramento River Valley	5a
San Joaquin River Valley	5b
Sacramento-San Joaquin Delta	5c
Tulare Lake Drainage	5d

To monitor quality of water in this basin, samples are collected from 119 stations on 50 separate watercourses and 1 lake as shown on Plate 4. The four areas and their respective watercourses are as listed:

Sacramento River Valley (5a)

Sacramento River
Colusa Trough
McCloud River
Pit River
Clear Creek
Cow Creek
Cottonwood Creek
Battle Creek
Paynes Creek
Redbank Creek
Elder Creek
Thomes Creek
Stony Creek
Clear Lake
Cache Creek
Putah Creek
Antelope Creek
Mill Creek
Big Chico Creek
Butte Creek
Feather River
Indian Creek
Yuba River
Bear River
American River

San Joaquin River Valley (5b)

San Joaquin River
Salt Slough
Fresno River
Chowchilla River
Bear Creek
Merced River
Tuolumne River
Stanislaus River
Delta-Mendota Canal

Sacramento-San Joaquin Delta (5c)

Lindsey Slough	Delta-Mendota Canal
Sacramento River	Italian Slough
Delta Cross Channel	Indian Slough
Little Potato Slough	Rock Slough
San Joaquin River	Cosumnes River
Stockton Ship Channel	Mokelumne River
Old River	Calaveras River
	Grant Line Canal

Tulare Lake Drainage (5d)

Kings River	Tule River
Kaweah River	Kern River

Four new stations were added to the surface water quality monitoring program in Region 5 during 1960. Sampling began in June 1960 for Sacramento River at Freeport (15b), and in July 1960 for Sacramento River at Boyer's Bend (14c), Sacramento River above Colusa Trough (14b), and Big Creek above Pine Flat Dam (33d). Two of these stations, 15b and 14b, replace the two stations which were discontinued, Sacramento River at Sacramento (15), and Sacramento River at Knights Landing (14).

Waters in the Central Valley Region vary in quality from excellent to poor, depending on locality, flow, and degradents encountered. Waters emanating from the Sierra Nevada, Cascade, and Trinity Mountains are generally of excellent quality, while surface runoff from the Tehachapi Mountains in the south and the coastal ranges along the western perimeter vary from excellent to poor. Waters in the Sacramento Valley and foothill slopes of the San Joaquin, Sacramento-San Joaquin Delta, and Tulare Lake drainage are generally calcium-bicarbonate in character. Waters on the San Joaquin Valley floor and in the Sacramento-San Joaquin Delta proper are usually sodium-chloride in character due to the effect of such degradents as irrigation return flows, ground water accretions, and sea-water incursion.

Below normal precipitation during 1960 and 1961 marked the second and third year of a drought period which has had considerable effect on the quality of waters in the Central Valley Region. The reduction in streamflow, coupled with heavy diversions for various uses, resulted in increased degradation of the quality of surface waters in the region. In periods of normal streamflow, sufficient diluting water is available to overcome these effects. Accordingly, increases in mineral concentration were recorded throughout the region, and many new maximum values of record for various constituents were established at a number of stations. However, except in the San Joaquin River Valley and the Sacramento-San Joaquin Delta, the increases in concentrations of mineral constituents were usually not significant.

Sacramento River Valley (5a)

The Sacramento River Valley embraces all of the watersheds tributary to Sacramento River upstream from the southern drainage boundaries of Putah Creek and the American River hydrographic units. The basin extends north-south approximately 270 miles and contains over 26,000 square miles of highly variable terrain.

Mountains and foothills cover about 65 percent of the area, with the Sierra Nevada dominating the eastern portion, the Coastal Range to the west, and the Klamath Mountains and Cascade Range on the north. Bountiful valley and mesa lands exist in this area, with the extensive agricultural lands of the Sacramento Valley being predominant in this land class.

Mean seasonal surface runoff exceeds 22,300,000 acre-feet in the area. To facilitate discussion of the numerous drainage areas in this area, they are segregated into the following units with the number of sampling stations of each in parentheses:

Sacramento River Unit (12)
McCloud River Basin (1)
Pit River Basin (4)
Redding Stream Unit (7)
West Side Stream Unit (12)
Sacramento Valley Northeast Stream Unit (6)
Feather River Basin (4)
Yuba-Bear Rivers Unit (4)
American River Basin (4)

During 1960 and 1961, mineral concentrations increased at a number of stations in the Sacramento River Valley and, at many stations, maximum values of record for various constituents were established. In most cases, these increases were of only slight significance.

Sacramento River Unit

The Sacramento River Unit extends from the northwesternmost corner of the Central Valley Region through the entire length of the Sacramento River Valley. The unit includes the drainage area of the Sacramento River above Shasta Reservoir, and the valley floor area of Sacramento Valley below Red Bluff. Mountainous terrain occupies all but a few of the 618 square miles along the reach of the river above Shasta Reservoir; while along its course below Red Bluff only Sutter Buttes breaks the 4,946 square miles of flat, gently rolling valley floor. Mean seasonal natural runoff for this unit is about 1,220,000 acre-feet.

Development along the upper reach is primarily associated with recreation or lumbering. Along the valley floor, agriculture and its allied food-processing industries are the primary economic endeavors. Mining, production of natural gas, recreation, and, in recent years, development related to military and aircraft programs, provide additional economic stability to the valley. These developments use considerable quantities of surface and ground water in their operations. Continued growth of the industrial and urban complex centers as well as irrigated agricultural expansion may, to a degree, depend upon controlling the effect these activities may have on the quality of the waters in the unit.

Waste discharges originating from industrial and municipal developments enter this major waterway along its entire length. In the upper reaches, lumber-mill effluent and sanitary sewage from resort communities constitute the major waste sources. In the valley floor area, lumber by-product industries, cities and towns, light industries, food product plants, and a considerable volume of irrigation return flow all combine to impose a significant waste load on the Sacramento River. The major discharges entering the river and their approximate quantities in million gallons per day (mgd) are listed:

City of Redding	2.0 mgd
City of Red Bluff	1.0 mgd
Diamond National Corporation	5.0 mgd
City of Corning (Intermittently)	0.3 mgd
City of Sacramento	50.0 mgd
West Sacramento Sanitary District	2.4 mgd
American Crystal Sugar Refining (Clarksburg)	5.0 mgd

The following tabulation presents the names of stations maintained to monitor quality of surface water in this basin and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Sacramento River at Delta	140
Sacramento River at Keswick	142
Sacramento River at Bend (Red Bluff)	144
Sacramento River near Hamilton City	146
Sacramento River at Butte City	148
Sacramento River at Colusa	150
Sacramento River at Boyers Bend	152
Sacramento River above Colusa Trough	154
Sacramento River at Knights Landing	156
Sacramento River at Sacramento	158
Sacramento River at Freeport	160
Colusa Trough near Colusa	162
Sacramento Slough near Knights Landing	164

SACRAMENTO RIVER AT DELTA (STA. 11)

Sampling Point. Station 11 is located in Section 35 of Township 36 North, Range 5 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank at the USGS gage 0.1 mile downstream from Dog Creek and 0.6 mile southeast of Delta, or off the left bank opposite the mouth of Dog Creek.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. During periods of higher surface runoff, the water was magnesium bicarbonate in character. In summer months, however, when flows were comparatively low, there was no major cation. The water was of excellent quality for all uses, class 1 for irrigation, soft to slightly hard (rarely) and met mineral standards for drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	239	55.7	152	74.6
Temperature in °F	82	36	74	42
Dissolved oxygen in parts per million	15.3	6.2	12.2	8.5
Percent saturation	124	68	101	89
pH	8.4	7.1	8.3	7.2
Mineral constituents in parts per million				
Calcium (Ca)	11	3.4	11	5.8
Magnesium (Mg)	8.5	4.0	6.4	5.8
Sodium (Na)	15	1.4	12	2.5
Potassium (K)	2.2	0.1	1.0	0.3
Carbonate (CO_3)	3	0.0	1	0.0
Bicarbonate (HCO_3)	87	30	86	40
Sulfate (SO_4)	5.0	0.0	3.0	0.0
Chloride (Cl)	12	0.0	10	0.2
Nitrate (NO_3)	0.6	0.0	0.2	0.0
Fluoride (F)	0.3	0.0	0.1	0.0
Boron (B)	0.3	0.0	0.2	0.0
Silica (SiO_2)	41	12	31	17
Total dissolved solids in parts per million	170	40	112	53
Percent sodium	38	9	32	12
Hardness as $CaCO_3$ in parts per million				
Total	62	26	61	32
Noncarbonate	6	0.0	5	0.0
Turbidity	600	0.0	15	2
Coliform in most probable number per milliliter	7,000.	0.045 -	230.	0.06
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.32	0.00	0.39	0.08
Solid alpha	2.81	0.00	0.16	0.0
Dissolved beta	19.6	0.00	1.0	0.0
Solid beta	9.18	0.00	8.1	0.0

WATER QUALITY VARIATIONS

SACRAMENTO RIVER AT DELTA (STA. NO. 11)

SACRAMENTO RIVER AT KESWICK (STA. 12)

Sampling Point. Station 12 is situated in Section 28 of Township 32 North, Range 5 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the USGS gage, 0.6 mile downstream from Keswick Dam, 0.6 mile upstream from Middle Creek, and 10 miles downstream from Shasta Dam.

Period of Record. April 1951 through December 1961.

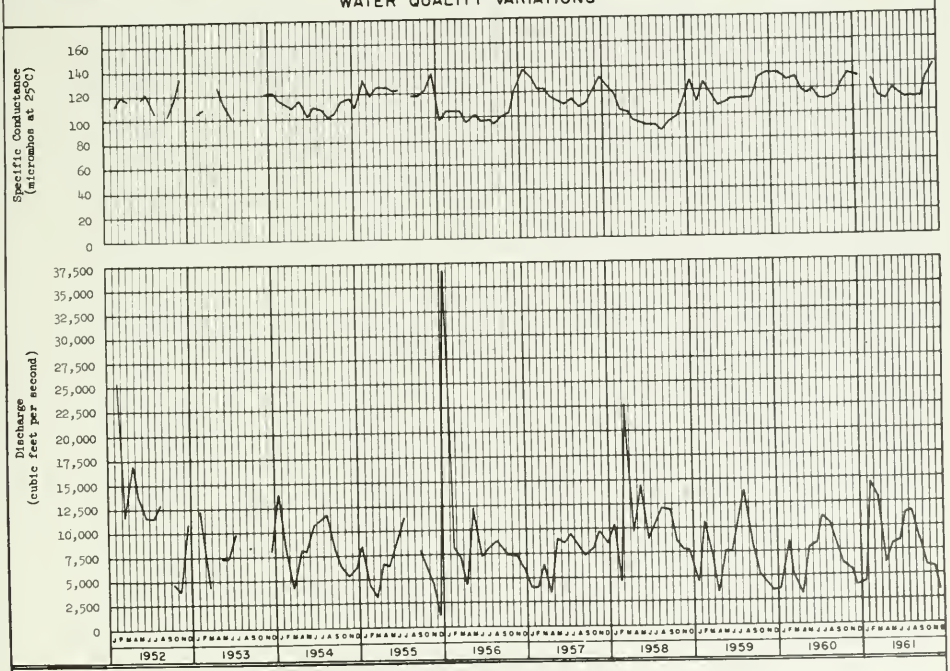
Water Quality Characteristics. Antecedent data show the water at Station 12 to be of excellent quality, soft to slightly hard, and to vary only slightly in mineral content. However, on several occasions during recent years, comparatively large concentrations of heavy metals coming from Spring Creek have been sufficient to kill fish in the vicinity of this station. Streams draining the Spring Creek watershed frequently are acidic and have undesirable heavy metal concentrations leached from tailings of both operating and abandoned mines. This situation has been partially corrected through increased releases from Shasta Reservoir coincident with increases of surface runoff in Spring Creek. The water at Station 12 is bicarbonate in type with calcium slightly dominant over other cations. This water is class 1 for irrigation, and excellent for domestic and industrial uses.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	139	86.5	138	112
Temperature in °F	60	41	58	48
Dissolved oxygen in parts per million	13.4	6.2	10.6	8.9
Percent saturation	119	57	96	77
pH	8.0	6.5	8.0	7.0
Mineral constituents in parts per million				
Calcium (Ca)	12	8.3	12	11
Magnesium (Mg)	6.3	1.9	4.5	3.6
Sodium (Na)	9.2	3.9	7.7	4.9
Potassium (K)	1.9	0.3	1.2	0.3
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	106	47	89	57
Sulfate (SO_4)	11.0	2.9	8.0	5.0
Chloride (Cl)	7.0	0.0	3.5	1.0
Nitrate (NO_3)	1.0	0.0	0.2	0.0
Fluoride (F)	0.3	0.0	0.1	0.1
Boron (B)	0.18	0.0	0.1	0.0
Silica (SiO_2)	29	15	23	23
Total dissolved solids in parts per million	102	67	100	81
Percent sodium	30	15	27	19
Hardness as $CaCO_3$ in parts per million				
Total	69	36	54	44
Noncarbonate	9	0.0	0.0	0.0
Turbidity	80	0.0	8	1
Coliform in most probable number per milliliter	7,000.	0.045 -	23.	0.045 -
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.33	0.00	0.31	0.0
Solid alpha	0.92	0.00	0.08	0.0
Dissolved beta	13.8	0.00	1.0	0.5
Solid beta	24.9	0.00	9.7	0.0

WATER QUALITY VARIATIONS



SACRAMENTO RIVER AT KESWICK (STA. NO. 12)

SACRAMENTO RIVER AT BEND (STA. 12c)

Sampling Point. Bend station is located in Section 20 of Township 28 North, Range 3 West, Mt. Diablo Base and Meridian. Daily composite and monthly grab samples were collected from the left bank 100 yards downstream from Bend Road Bridge, 4.0 miles upstream from the mouth of Paynes Creek, and approximately 6.0 miles north of Red Bluff.

Period of Record. May 1955 through December 1961.

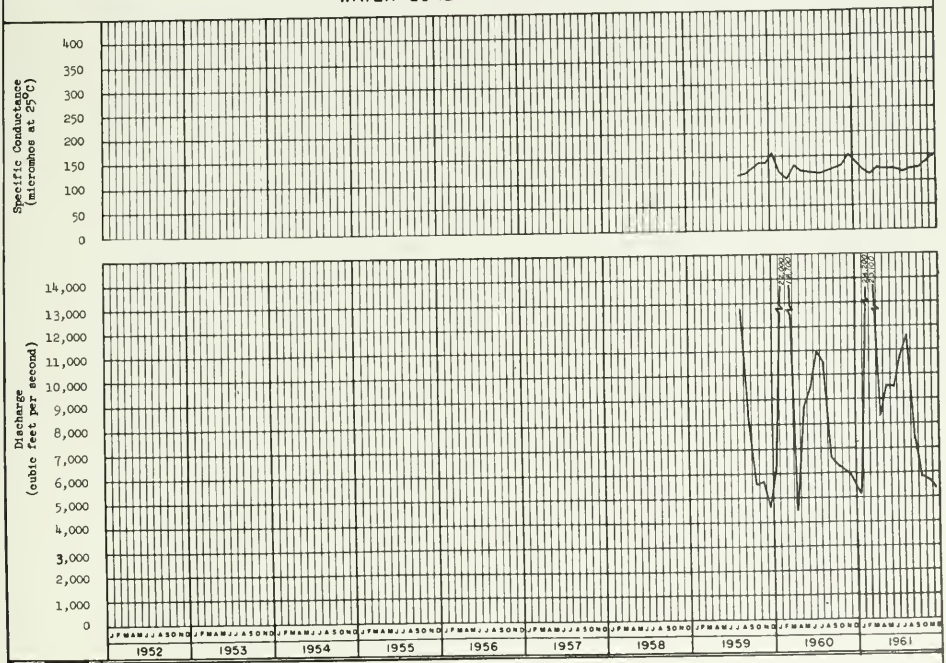
Water Quality Characteristics. Sacramento River at Station 12c is calcium-magnesium bicarbonate in type, soft, class 1 for irrigation use, and suitable for domestic and industrial use.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	179	67.4	150	110
Temperature in °F	61	45	61	46
Dissolved oxygen in parts per million	11.2	8.4	11.2	9.7
Percent saturation	104	88	101	95
pH	8.1	6.1	8.1	7.1
Mineral constituents in parts per million				
Calcium (Ca)	15	7.6	12	7.6
Magnesium (Mg)	7.3	2.4	6.3	3.9
Sodium (Na)	11	2.4	7.7	5.2
Potassium (K)	3.0	0.6	2.0	0.7
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	100	28	78	48
Sulfate (SO_4)	16	1.2	11	3.6
Chloride (Cl)	13	4.1	5.2	1.2
Nitrate (NO_3)	4.2	0.0	1.3	0.0
Fluoride (F)	0.6	0.1	0.3	0.0
Boron (B)	0.46	0.0	0.2	0.0
Silica (SiO_2)	45	14	29	21
Total dissolved solids in parts per million	141	48	115	77
Percent sodium	28	14	26	18
Hardness as $CaCO_3$ in parts per million				
Total	71	26	56	40
Noncarbonate	14	0.0	3	0
Turbidity	350	0.4	70	0.4
Coliform in most probable number per milliliter	24,000.+	0.62	7,000.+	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.08	0.0	0.08	0.0
Solid alpha	2.27	0.0	0.08	0.0
Dissolved beta	8.26	0.4	3.4	0.4
Solid beta	10.8	4.81	10.8	8.6

WATER QUALITY VARIATIONS



SACRAMENTO RIVER AT BEND (STA. NO. 12c)

SACRAMENTO RIVER NEAR HAMILTON CITY (STA. 13)

Sampling Point. Station 13 is located in Section 20 of Township 22 North, Range 1 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from a state highway bridge 10.5 miles west of Chico, 1.2 miles northeast of Hamilton City, and about 6.0 miles upstream from the mouth of Stony Creek.

Period of Record. April 1951 through December 1961.

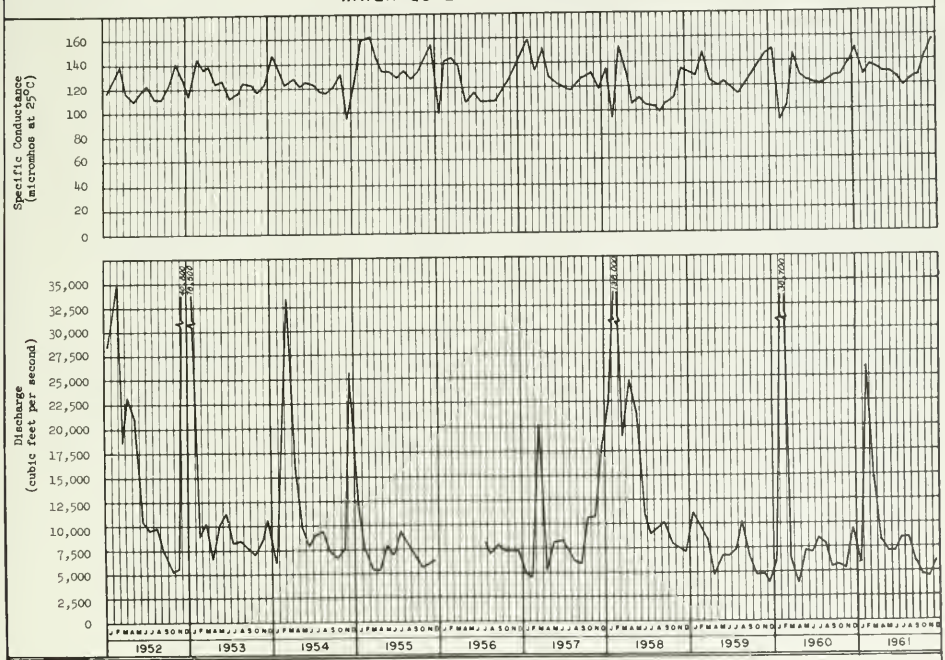
Water Quality Characteristics. Analyses of the water at the sampling point shows the water to be calcium-magnesium bicarbonate in character. The water is soft to slightly hard, class 1 for irrigation, meets drinking water requirements for mineral content, and is excellent for industrial use.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	161	93.5	157	119
Temperature in °F	72	41	65	47
Dissolved oxygen in parts per million	12.9	4.3	11.5	8.8
Percent saturation	110	42	99	90
pH	8.1	6.8	8.0	7.2
Mineral constituents in parts per million				
Calcium (Ca)	15	6.8	11	11
Magnesium (Mg)	7.9	3.1	5.7	5.2
Sodium (Na)	11.9	3.8	8.4	5.8
Potassium (K)	2.1	0.6	1.1	0.8
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	132	38	80	64
Sulfate (SO_4)	9.0	1.0	8.8	5.0
Chloride (Cl)	9.0	0.0	6.5	1.9
Nitrate (NO_3)	1.1	0.0	0.5	0.0
Fluoride (F)	0.3	0.0	0.2	0.1
Boron (B)	0.35	0.0	0.2	0.0
Silica (SiO_2)	27	20	26	22
Total dissolved solids in parts per million	116	68	113	86
Percent sodium	35	16	25	20
Hardness as $CaCO_3$ in parts per million				
Total	68	37	61	46
Noncarbonate	15	0.0	4	0.0
Turbidity	350	0.0	15	0.4
Coliform in most probable number per milliliter	7,000. +	0.06	7,000.	0.13
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.50	0.00	0.50	0.25
Solid alpha	1.43	0.00	0.0	0.00
Dissolved beta	12.00	0.00	3.3	2.7
Solid beta	15.5	0.00	15.5	5.2

WATER QUALITY VARIATIONS



SACRAMENTO RIVER NEAR HAMILTON CITY (STA. NO. 13)

SACRAMENTO RIVER AT BUTTE CITY (STA. 87a)

Sampling Point. Station 87a is located in Section 32 of Township 19 North, Range 1 West, Mt. Diablo Base and Meridian. Monthly grab and daily composite samples were collected at the highway bridge just downstream from the gaging station and 0.5 mile south of Butte City.

Period of Record. May 1955 through December 1961.

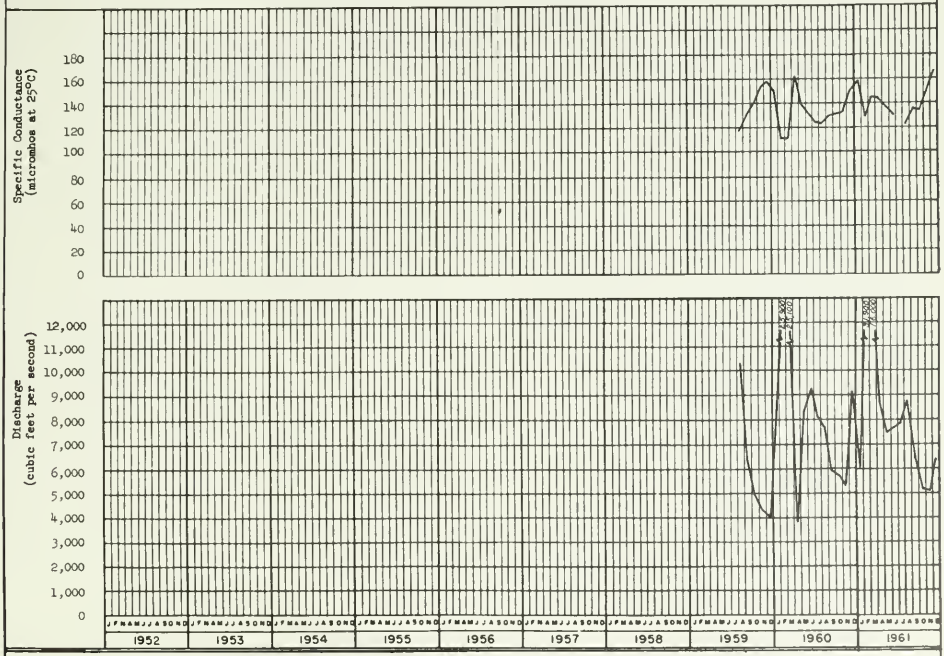
Water Quality Characteristics. Analyses of daily composite samples show the water at Station 87a to be bicarbonate in type with calcium the major cation, soft to slightly hard, class 1 for irrigation use, and within drinking water standards for mineral content. Comparison of analyses of samples from this station with those from the Sacramento River at Hamilton City (Station 13) reveals no significant difference in mineral quality.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	201	68.2	167	122
Temperature in °F	69	45	65	47
Dissolved oxygen in parts per million	11.7	7.9	11.7	7.9
Percent saturation	104	82	104	82
pH	8.1	6.6	8.1	7.1
Mineral constituents in parts per million				
Calcium (Ca)	17	7.9	14	10
Magnesium (Mg)	9.7	3.2	8.5	4.1
Sodium (Na)	14	4.0	10	5.9
Potassium (K)	4.7	0.8	4.7	0.8
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	106	40	102	57
Sulfate (SO_4)	16	0.6	12	0.6
Chloride (Cl)	12	0.7	6.0	1.8
Nitrate (NO_3)	4.5	0.0	2.4	0.0
Fluoride (F)	0.7	0.0	0.2	0.0
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	43	14	29	19
Total dissolved solids in parts per million	152	65	121	86
Percent sodium	28	15	26	20
Hardness as $CaCO_3$ in parts per million				
Total	75	35	68	47
Noncarbonate	11	0.0	4	0
Turbidity	500	2	70	2
Coliform in most probable number per milliliter	620.	2.3	620.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.23	0.00	0.21	0.07
Solid alpha	0.22	0.00	0.22	0.0
Dissolved beta	4.3	0.0	0.0	0.0
Solid beta	0.64	0.0	0.5	0.0

WATER QUALITY VARIATIONS



SACRAMENTO RIVER AT BUTTE CITY (STA. NO. 87a)

SACRAMENTO RIVER AT COLUSA (STA. 13b)

Sampling Point. Colusa station is located within Section 32 of Township 19 North, Range 1 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the River Road bridge at Colusa.

Period of Record. October 1958 through December 1961.

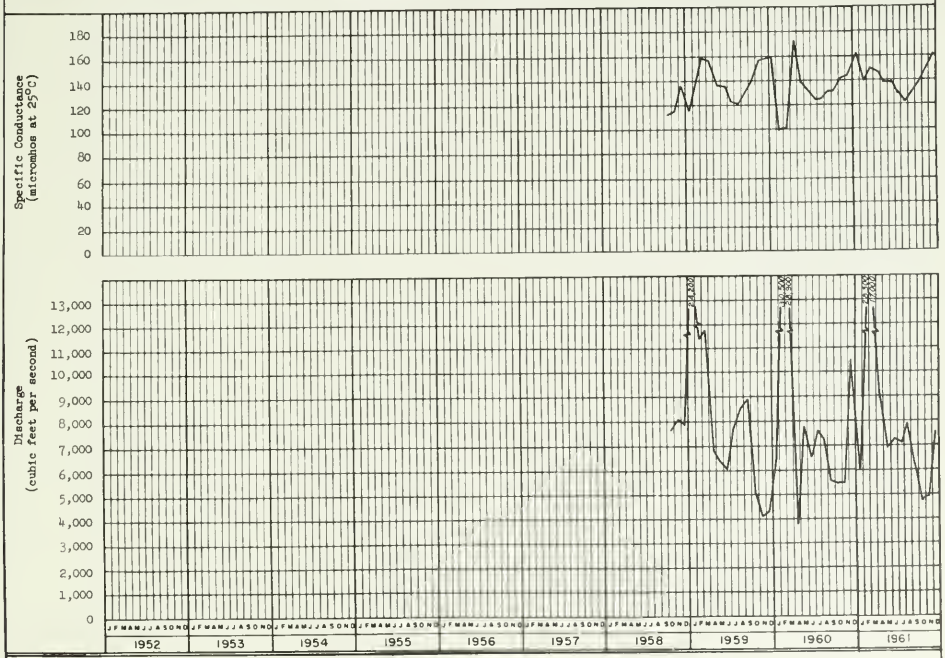
Water Quality Characteristics. Water at this station is excellent in quality, calcium-magnesium bicarbonate in type, soft to slightly hard, class 1 for irrigation, and meets drinking water requirements.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	171	97.5	162	123
Temperature in °F	72	45	67	46
Dissolved oxygen in parts per million	11.4	8.0	11.2	8.0
Percent saturation	100	83	100	86
pH	8.0	7.1	8.0	7.2
Mineral constituents in parts per million				
Calcium (Ca)	14	9.6	12	12
Magnesium (Mg)	7.8	3.3	6.3	5.6
Sodium (Na)	11	4.2	9.8	6.3
Potassium (K)	1.9	0.9	1.3	1.3
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	90	39	80	66
Sulfate (SO_4)	15	2.9	6.2	5.0
Chloride (Cl)	10	1.8	7.0	1.8
Nitrate (NO_3)	2.0	0.0	0.4	0.0
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.2	0.0	0.1	0.0
Silica (SiO_2)	34	18	28	22
Total dissolved solids in parts per million	127	72	119	91
Percent sodium	28	17	28	20
Hardness as $CaCO_3$ in parts per million				
Total	68	42	62	50
Noncarbonate	13	0.0	2	0.0
Turbidity	700	1	60	3
Coliform in most probable number per milliliter (Not measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.68	0.00	0.33	0.0
Solid alpha	0.39	0.00	0.17	0.0
Dissolved beta	3.44	0.00	0.4	0.0
Solid beta	7.86	0.0	3.0	0.0

WATER QUALITY VARIATIONS



SACRAMENTO RIVER AT COLUSA (STA. NO. 13b)

SACRAMENTO RIVER AT BOYERS BEND (14c)

Sampling Point. Station 14c is located in Section 22, Township 13 North, Range 1 East, Mt. Diablo Base and Meridian. Daily composite samples were collected from a pump pier on the right bank, 1,200 feet downstream from Millers Landing, 4.1 miles north of Kirkville, and 8.6 miles southeast of Grimes.

Period of Record. July 1960 through December 1961. This station replaces the daily sampling station Sacramento River at Knights Landing (14) which was discontinued in June 1960.

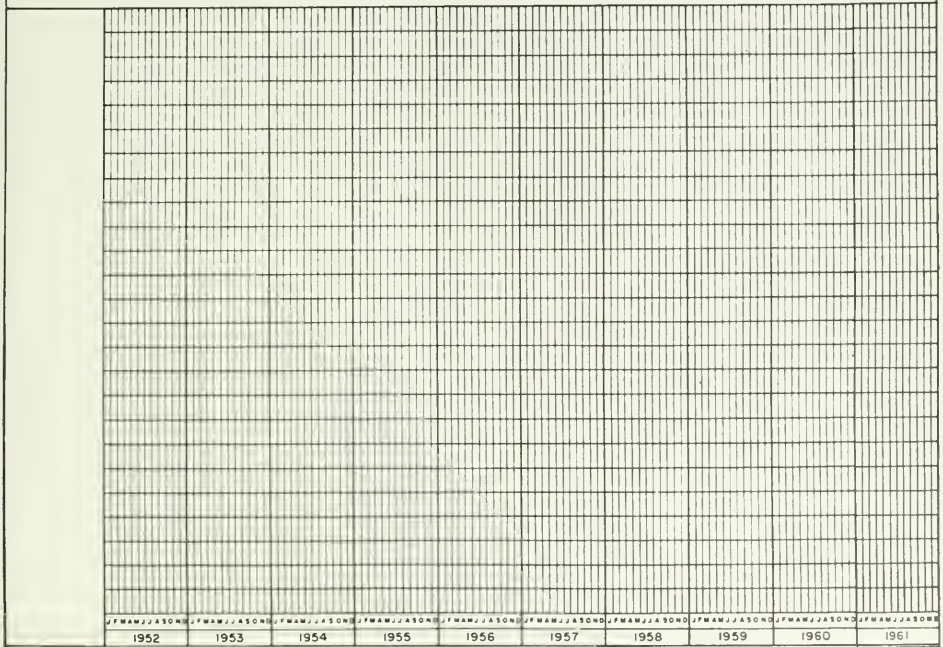
Water Quality Characteristics. Water in the Sacramento River at Boyers Bend is bicarbonate in type with calcium a slightly predominant cation. It is soft, meets drinking water requirements for mineral content, and is class 1 for irrigation.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	179	95.4	179	122
Temperature in °F				
Dissolved oxygen in parts per million				
Percent saturation				
pH	8.2	7.0	8.2	7.2
Mineral constituents in parts per million				
Calcium (Ca)	14	8.0	14	10
Magnesium (Mg)	8.1	3.8	8.1	4.7
Sodium (Na)	12	5.1	12	5.9
Potassium (K)	2.3	0.6	1.6	0.6
Carbonate (CO_3)	0.5	0.0	0.0	0.0
Bicarbonate (HCO_3)	95	40	95	52
Sulfate (SO_4)	11	3.6	11	3.6
Chloride (Cl)	5.0	1.4	4.2	3.0
Nitrate (NO_3)	2.6	0.0	2.4	0.0
Fluoride (F)	0.3	0.0	0.2	0.0
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	37	20	37	20
Total dissolved solids in parts per million	132	73	125	75
Percent sodium	28	20	28	20
Hardness as $CaCO_3$ in parts per million				
Total	68	36	68	47
Noncarbonate	5	0	5	0
Turbidity				
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter (Not Measured)				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid beta				

WATER QUALITY VARIATIONS



SACRAMENTO RIVER AT BOYERS BEND (STA. NO. 14c)

SACRAMENTO RIVER ABOVE COLUSA TROUGH (STA. 14b)

Sampling Point. Station 14b is located in Section 14 of Township 11 North, Range 2 East, Mt. Diablo Base and Meridian. Samples are taken from the right bank at the irrigation pump or 150 feet upstream from same, approximately one-fourth mile upstream from the Colusa Basin Drain outfall gates at Knights Landing.

Period of Record. July 1960 through December 1961. (Replaces Station 14)

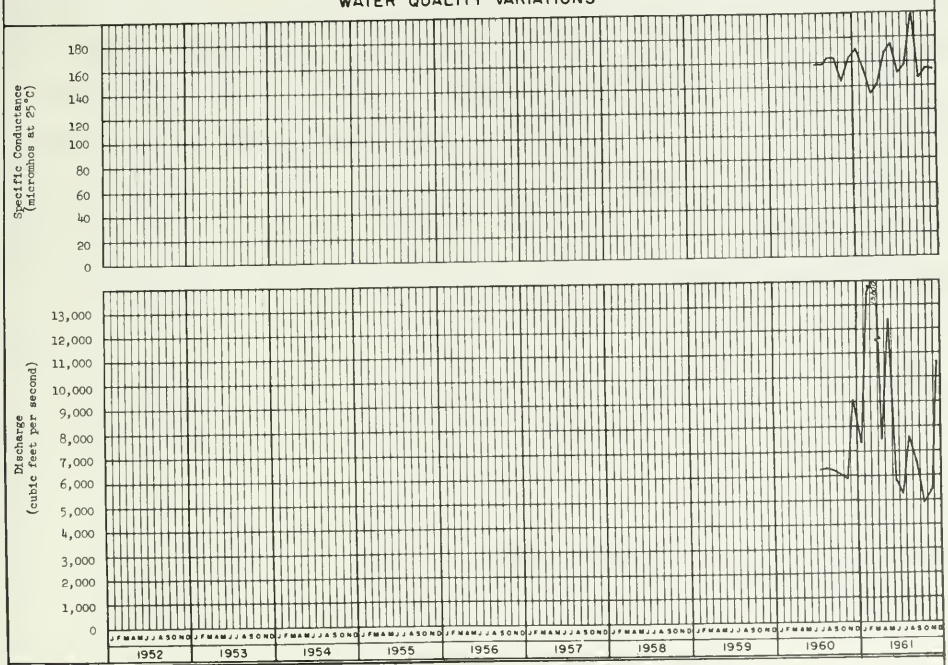
Water Quality Characteristics. From examination of limited analyses, the river at Station 14b is bicarbonate in character with no specific cation predominant, soft to slightly hard, class 1 for irrigation, and within drinking water requirements for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	198	134	198	134
Temperature in °F	72	44	72	44
Dissolved oxygen in parts per million	10.8	8.0	10.5	8.4
Percent saturation	104	81	104	81
pH	8.2	7.0	8.2	7.0
Mineral constituents in parts per million				
Calcium (Ca)	14	14	14	14
Magnesium (Mg)	8.3	6.6	8.3	6.6
Sodium (Na)	14	4.4	14	4.4
Potassium (K)	2.3	1.1	2.3	1.1
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	97	60	97	60
Sulfate (SO_4)	12	9.4	12	9.4
Chloride (Cl)	8.0	2.0	8.0	2.0
Nitrate (NO_3)	0.3	0.2	0.3	0.3
Fluoride (F)	0.1	0.0	0.1	0.0
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	25	23	24	23
Total dissolved solids in parts per million	130	90	130	90
Percent sodium	30	14	30	14
Hardness as $CaCO_3$ in parts per million				
Total	69	52	69	52
Noncarbonate	7	0	7	0.0
Turbidity	170	5	170	5
Coliform in most probable number per milliliter	7,000. +	0.62	7,000. +	1.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.33	0.17	0.33	0.19
Solid alpha	0.75	0.00	0.75	0.03
Dissolved beta	6.32	0.0	6.32	0.0
Solid beta	6.60	3.1	6.60	5.5

WATER QUALITY VARIATIONS



SACRAMENTO RIVER ABOVE COLUSA TROUGH (STA. NO. 14b)

SACRAMENTO RIVER AT KNIGHTS LANDING (STA. 14)

Sampling Point. Knights Landing station is located in Section 14 of Township 11 North, Range 2 East, Mt. Diablo Base and Meridian. Daily composites and monthly grab samples were collected at the Southern Pacific Railroad bridge at Knights Landing.

Period of Record. April 1951 through May 1960. In June 1960, this station was replaced by Station 14b, Sacramento River above Colusa Drain. Analysis of data obtained during the course of the Sacramento River Water Pollution Survey indicated that inflow from the Colusa Basin Drain was not completely dispersed throughout the cross section of the Sacramento River at this point. Accordingly, to obtain more representative samples, the station was relocated. A new daily sampling station in lieu of Station 14 was established at Boyer's Bend (14c).

Water Quality Characteristics. Water in Sacramento River at Knights Landing is bicarbonate in type with sodium the predominant cation. The water is slightly hard to moderately hard, meets drinking water requirements for mineral content, and is generally class 1 for irrigation. In August 1954, however, boron reached 0.86 ppm placing this water in class 2 for irrigation. Comparison of analyses of samples from Station 14 with those of water from the Colusa station show that mineral concentrations become considerably higher (on the order of 160 micromhos) in Sacramento River at Knights Landing. Numerous irrigation drainage waters entering the river between these two stations account for the higher mineral concentrations at Station 14.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1960	Minimum - 1960
Specific conductance (micromhos at 25°C)	676	85	358	109
Temperature in °F	81	43	71	43
Dissolved oxygen in parts per million	12.8	4.0	11.6	7.9
Percent saturation	109	42	94	89
pH	8.3	6.8	8.1	7.0
Mineral constituents in parts per million				
Calcium (Ca)	38	8.0	19	3.0
Magnesium (Mg)	20	3.4	14	5.5
Sodium (Na)	85	2.5	41	4.9
Potassium (K)	6.8	0.65	2.6	1.2
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	263	36	140	53
Sulfate (SO_4)	52	2.4	47	9.0
Chloride (Cl)	57	2.0	19	3.5
Nitrate (NO_3)	2.2	0.0	2.2	0.2
Fluoride (F)	0.5	0.0	0.3	0.0
Boron (B)	0.86	0.0	0.2	0.0
Silica (SiO_2)	33	15	33	15
Total dissolved solids in parts per million	423	59	228	79
Percent sodium	52	13	45	18
Hardness as $CaCO_3$ in parts per million				
Total	169	36	104	47
Noncarbonate	16	0.0	6.0	0.0
Turbidity in parts per million	600	0.0	150	3
Coliform in most probable number per milliliter	7,000. +	0.046	620.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.42	0.00	0.38	0.18
Solid alpha	0.67	0.00	0.40	0.09
Dissolved beta	6.86	0.00	6.86	0.00
Solid beta	14.75	0.00	3.83	0.00

WATER QUALITY VARIATIONS

SACRAMENTO RIVER AT KNIGHTS LANDING (STA. NO. 14)

SACRAMENTO RIVER AT SACRAMENTO (STA. 15)

Sampling Point. Station 15 is located in Section 35 of Township 9 North, Range 4 East, Mt. Diablo Base and Meridian. Daily composites and monthly grab samples were collected at Tower Bridge, 0.4 mile downstream from the gaging station at Sacramento, and about 1.3 miles downstream from the confluence of the American and Sacramento Rivers.

Period of Record. April 1951 through May 1960. In May of 1960, this station was relocated 13.3 miles downstream to Freeport (Station 15b). Analysis of data obtained during the course of the Sacramento River Water Pollution Survey indicated that accretions from the American River (1.3 miles upstream from the Sacramento station) under certain hydrologic conditions, were not evenly dispersed throughout the cross section of the Sacramento River at the point of sampling. In order to insure representative sampling under all hydrologic conditions, it was necessary to relocate this station.

Water Quality Characteristics. Mineral analyses of samples taken at Station 15 indicate the water to be bicarbonate in type with calcium and magnesium about equal in predominance as the major cations, soft to slightly hard, class 1 for irrigation, suitable for all but the most exacting industrial uses, and within drinking water requirements for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1960	Minimum - 1960
Specific conductance (micromhos at 25°C)	296	57.1	196	86.9
Temperature in °F	78	41	60	41
Dissolved oxygen in parts per million	14.0	7.5	10.7	9.0
Percent saturation	116	79	93	84
pH	8.2	6.4	7.3	7.3
Mineral constituents in parts per million				
Calcium (Ca)	19	2.4	15	8.0
Magnesium (Mg)	12	1.1	9.7	1.1
Sodium (Na)	25	1.9	14	3.6
Potassium (K)	2.3	0.6	2.1	1.0
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	132	26	92	39
Sulfate (SO_4)	20	1.0	19	5.0
Chloride (Cl)	34	1.0	16	1.0
Nitrate (NO_3)	4.8	0.0	3.3	0.2
Fluoride (F)	0.4	0.0	0.4	0.0
Boron (B)	0.39	0.00	0.1	0.00
Silica (SiO_2)	34	0.0	27	0.0
Total dissolved solids in parts per million	179	41	142	46
Percent sodium	37	14	31	17
Hardness as $CaCO_3$ in parts per million				
Total	97	22	71	31
Noncarbonate	11	0.0	10	0
Turbidity in parts per million	170	4	100	15
Coliform in most probable number per milliliter	7,000.	0.21	230	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.67	0.00	0.23	
Solid alpha	0.70	0.00	0.70	
Dissolved beta	6.79	0.00	6.79	
Solid beta	12.96	0.00	5.85	

WATER QUALITY VARIATIONS

SACRAMENTO RIVER AT SACRAMENTO (STA. NO. 15)

SACRAMENTO RIVER AT FREEPORT (STA. 15b)

Sampling Point. Station 15b is located in Section 14 of Township 7 North, Range 4 East, Mt. Diablo Base and Meridian. Daily composites and monthly grab samples were collected from the platform at the office of the bridge tender on the Freeport Bridge which is located approximately 2.5 miles downstream from the USGS gaging station.

Period of Record. June 1960 through December 1961. (Replaces Station 15)

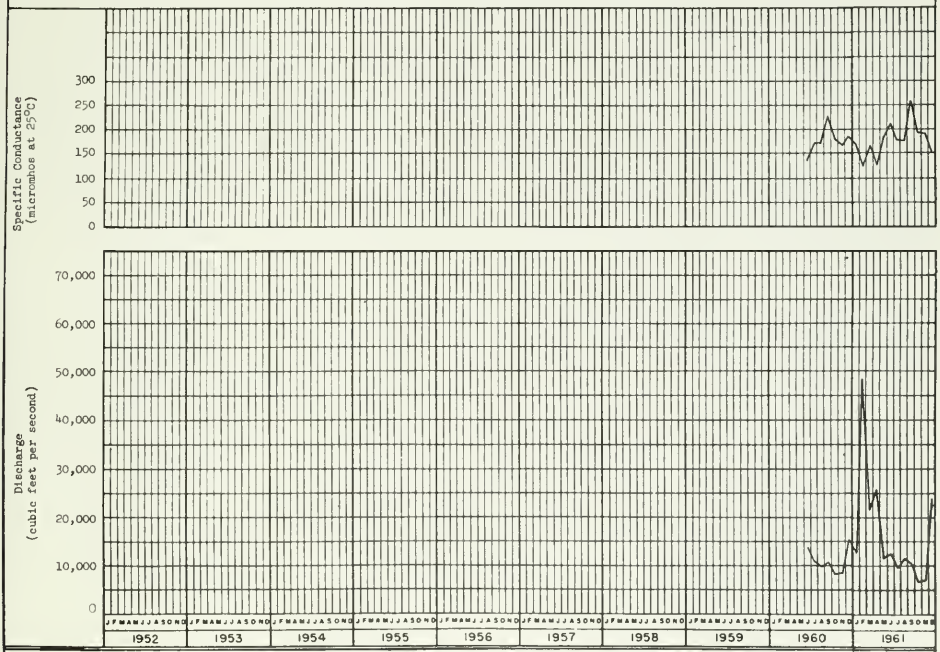
Water Quality Characteristics. Mineral analyses show the water at this station to be bicarbonate in type with calcium, magnesium, and sodium nearly equal, soft to slightly hard, class 1 for irrigation water, and within drinking water requirements for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	259	111	259	123
Temperature in °F	73	45	73	45
Dissolved oxygen in parts per million	11.5	7.1	11.5	7.1
Percent saturation	99	79	99	79
pH	7.7	7.1	7.7	7.1
Mineral constituents in parts per million				
Calcium (Ca)	18	8.8	18	11
Magnesium (Mg)	12	4.4	12	5.0
Sodium (Na)	21	3.8	21	3.8
Potassium (K)	1.6	0.0	1.6	0.5
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	121	43	121	53
Sulfate (SO_4)	16	6.0	16	6.0
Chloride (Cl)	15	3.0	15	3.0
Nitrate (NO_3)	3.4	0.0	2.3	0.2
Fluoride (F)	0.3	0.0	0.3	0.0
Boron (B)	0.2	0.00	0.2	0.00
Silica (SiO_2)	29	16	26	18
Total dissolved solids in parts per million	169	72	169	81
Percent sodium	36	14	34	14
Hardness as $CaCO_3$ in parts per million				
Total	91	40	91	48
Noncarbonate	10	0	7	0
Turbidity	150	4	150	4
Coliform in most probable number per milliliter	>7,000.	0.046	>7,000.	0.046
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.26	0.17	0.26	0.17
Solid alpha	0.68	0.10	0.33	0.10
Dissolved beta	6.54	1.5	6.54	1.5
Solid beta	12.1	0.0	12.1	0.0

WATER QUALITY VARIATIONS



SACRAMENTO RIVER AT FREEPORT (STA. NO. 15b)

COLUSA TROUGH NEAR COLUSA (STA. 87)

Sampling Point. Station 87 is located in Section 34, Township 16 North, Range 2 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected near the surface, along the right bank, 100 feet downstream from State Highway 120 bridge, 3 miles west of Colusa.

Period of Record. July 1952 through December 1961.

Water Quality Characteristics. Analyses showed Colusa Trough water to be generally sodium-magnesium bicarbonate, and occasionally class 2 for irrigation due to conductivity. Hardness ranged from slightly hard to very hard. During the irrigation season this water is chiefly return flow from Colusa Basin and reflects the mineralized conditions of waters used and reused for agricultural purposes.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,670	269	1,300	416
Temperature in °F	86	43	78	43
Dissolved oxygen in parts per million	12.4	4.9	11.3	6.6
Percent saturation	113	46	95	73
pH	8.4	6.8	8.4	7.5
Mineral constituents in parts per million				
Calcium (Ca)	70	15	26	21
Magnesium (Mg)	73	9.4	17	16
Sodium (Na)	224	26	163	39
Potassium (K)	5.4	1.1	2.6	1.8
Carbonate (CO_3)	14	0.0	10	0.0
Bicarbonate (HCO_3)	363	96	308	146
Sulfate (SO_4)	226	19	64	33
Chloride (Cl)	172	2.2	110	21
Nitrate (NO_3)	5.8	0.0	1.6	0.0
Fluoride (F)	0.6	0.0	0.4	0.3
Boron (B)	0.4	0.0	0.4	0.1
Silica (SiO_2)	30	9.9	18	18
Total dissolved solids in parts per million	990	160	774	248
Percent sodium	58	34	54	39
Hardness as $CaCO_3$ in parts per million				
Total	418	76	329	119
Noncarbonate	129	0.0	65	0.0
Turbidity	700	9	500	2
Coliform in most probable number per milliliter	7,000. +	5.	7,000.	13.
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.63	0.00	0.30	0.0
Solid alpha	0.68	0.00	0.68	0.27
Dissolved beta	34.3	0.00	34.3	2.2
Solid beta	10.6	0.00	10.6	1.8

WATER QUALITY VARIATIONS

COLUSA TROUGH NEAR COLUSA (STA. NO. 87)

SACRAMENTO SLOUGH NEAR KNIGHTS LANDING (STA. 14a)

Sampling Point. The station is within Section 20, Township 11 North, Range 2 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected near the surface from the center of the stream, from a bridge crossing Sutter Bypass, near the discharge pipes from Reclamation District 1500 pumping plant about 4 miles east of Knights Landing.

Period of Record. June 1951 through December 1961.

Water Quality Characteristics. Analyses showed this water to be a bicarbonate type with no one cation predominant, and class 1 for irrigation use. Water from Sacramento Slough is slightly to moderately hard. Flow in this slough is chiefly irrigation return and local drainage from Reclamation District 1500.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	729	106	627	174
Temperature in °F	84	41	78	43
Dissolved oxygen in parts per million	12.5	5.7	10.0	6.5
Percent saturation	107	65	95	68
pH	8.4	6.9	8.4	7.0
Mineral constituents in parts per million				
Calcium (Ca)	43	11	31	27
Magnesium (Mg)	30	4.9	19	18
Sodium (Na)	66	5.0	54	10
Potassium (K)	3.2	0.9	2.6	2.0
Carbonate (CO_3)	5	0.0	5	0.0
Bicarbonate (HCO_3)	272	53	238	81
Sulfate (SO_4)	54	3.8	10	5.0
Chloride (Cl)	114	3.2	77	7.2
Nitrate (NO_3)	1.8	0.0	0.5	0.4
Fluoride (F)	0.4	0.0	0.1	0.0
Boron (B)	0.2	0.0	0.1	0.0
Silica (SiO_2)	36	15	30	24
Total dissolved solids in parts per million	440	64	376	104
Percent sodium	48	18	38	25
Hardness as $CaCO_3$ in parts per million				
Total	218	44	195	65
Noncarbonate	37	0.0	8	0.0
Turbidity	600	5	280	16
Coliform in most probable number per milliliter	7,000. +	0.62	2,400.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.48	0.00	0.16	0.0
Solid alpha	1.07	0.00	1.07	0.41
Dissolved beta	3.97	0.00	1.7	0.06
Solid beta	9.23	0.00	8.0	0.0

WATER QUALITY VARIATIONS

SACRAMENTO SLOUGH NEAR KNIGHTS LANDING (STA. NO. 14a)

McCloud River Basin

McCloud River watershed lies immediately north of Shasta Reservoir in the northern portion of the Central Valley Region. The river basin drains a heavily forested, predominantly mountainous terrain. Valley and mesa lands cover about 15 percent of the 685 square miles in the McCloud River Basin. Estimated mean seasonal runoff is 1,403,000 acre-feet.

Timber production provides the major stimulus for the economy of this basin. Livestock raising and recreation provides a supplement to the economic development. Water use and waste discharges of these developments are comparatively minor and have not created problems of any consequence.

To maintain surveillance on quality of runoff from this basin a monitoring station is located on McCloud River above Lake Shasta.

McCLOUD RIVER ABOVE SHASTA LAKE (STA. 18)

Sampling Point. Station 18 is located in Section 31 of Township 36 North, Range 3 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank, just above the backwater of Shasta Lake, 11 miles east of the town of Delta.

Period of Record. April 1951 through December 1961.

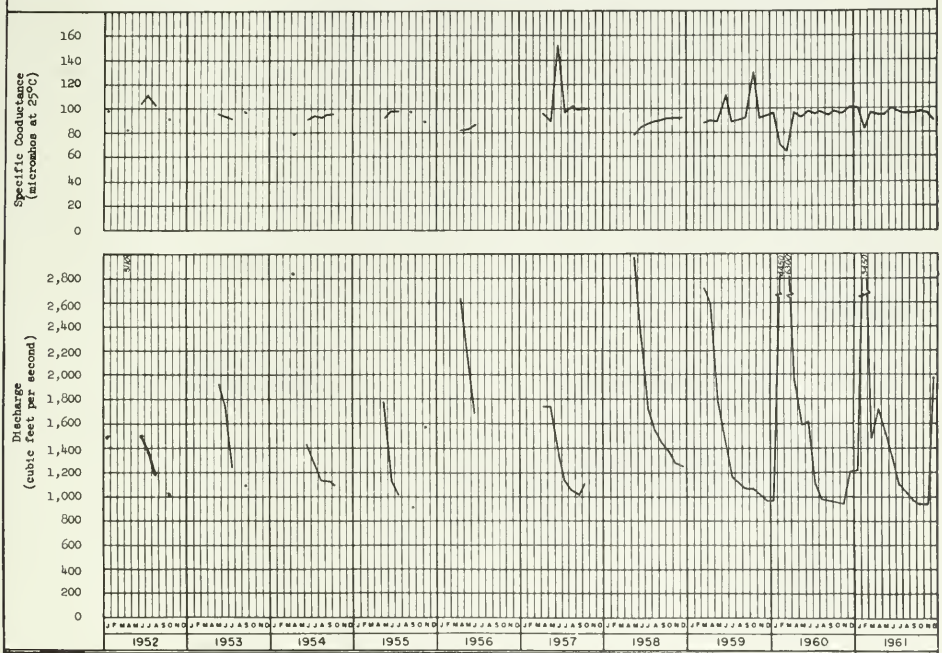
Water Quality Characteristics. Past analyses show the water to be calcium bicarbonate in character, class 1 for irrigation, soft and within drinking water standards for mineral content. The station is generally inaccessible during the winter months and, therefore, samples are usually collected only during the spring, summer, and fall months. However, during the 1960 and 1961 years, samples were obtained each month due to the mild winters.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	150	67.1	100	82.2
Temperature in °F	61	41	58	41
Dissolved oxygen in parts per million	14.1	7.5	11.9	9.8
Percent saturation	124	61	98	92
pH	8.1	7.1	8.1	7.1
Mineral constituents in parts per million				
Calcium (Ca)	13	8.0	10	10
Magnesium (Mg)	5.1	2.1	3.6	3.2
Sodium (Na)	9.9	2.0	7.6	2.8
Potassium (K)	2.5	0.6	1.3	1.2
Carbonate (CO_3)	1	0.0	0.0	0.0
Bicarbonate (HCO_3)	86	34	66	49
Sulfate (SO_4)	3.0	0.0	1.4	1.0
Chloride (Cl)	8.0	0.0	2.8	0.1
Nitrate (NO_3)	1.0	0.0	0.2	0.2
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.72	0.0	0.1	0.0
Silica (SiO_2)	41	25	37	31
Total dissolved solids in parts per million	134	60	89	73
Percent sodium	29	12	29	13
Hardness as $CaCO_3$ in parts per million				
Total	54	30	44	35
Noncarbonate	2	0.0	0.0	0.0
Turbidity	60	0.0	8	0.0
Coliform in most probable number per milliliter	7,000. +	0.045 -	2,400.	0.046
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.52	0.00	0.52	0.30
Solid alpha	0.55	0.0	0.17	0.0
Dissolved beta	10.80	0.00	0.0	0.0
Solid beta	5.96	0.00	2.0	0.0

WATER QUALITY VARIATIONS



McCLOUD RIVER ABOVE SHASTA LAKE (STA. NO. 18)

Pit River Basin

Runoff from 5,758 square miles in California (including Goose Lake Basin) drains into the Pit River. Goose Lake Basin in California comprises 412 square miles which, during extremely wet years, spills over into the Pit River. Included with the Pit River Unit Basin are some 2,270 square miles of valley and mesa lands. Prominent among the valley fill areas are South Fork Pit River, Big Valley, Goose Lake, and Fall River. Estimated mean annual runoff of Pit River Basin is 3,426,000 acre-feet.

Topography of the area is characterized by several large upland valley areas, ranging in elevation from 2,500 to 5,000 feet, surrounded by rugged, volcanic peaks of the Cascade Range. These mountain and valley lands are used extensively for dry range for livestock and also support irrigated agriculture, timber production, mining, and recreation.

Waste discharges from several small communities, lumbermills, and local light industries enter the Pit River along its course. These wastes are minor, the largest being less than 0.5 mgd (from the City of Alturas), and do not create any significant pollution or impairment problems.

The following tabulation presents the names of stations maintained to monitor quality of surface water in this basin and the page on which each is discussed:

Monitoring Station	Page Number of Station Discussion
Pit River near Canby	172
Pit River near Bieber	174
Pit River near Montgomery Creek	176
Pit River, South Fork near Likely	178

PIT RIVER NEAR CANBY (STA. 17a)

Sampling Point. The Canby station is situated in Section 10 of Township 41 North, Range 9 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the center of the channel of flow from the Highway 299 bridge, 4.5 miles southwest of Canby.

Period of Record. April 1951 through December 1961.

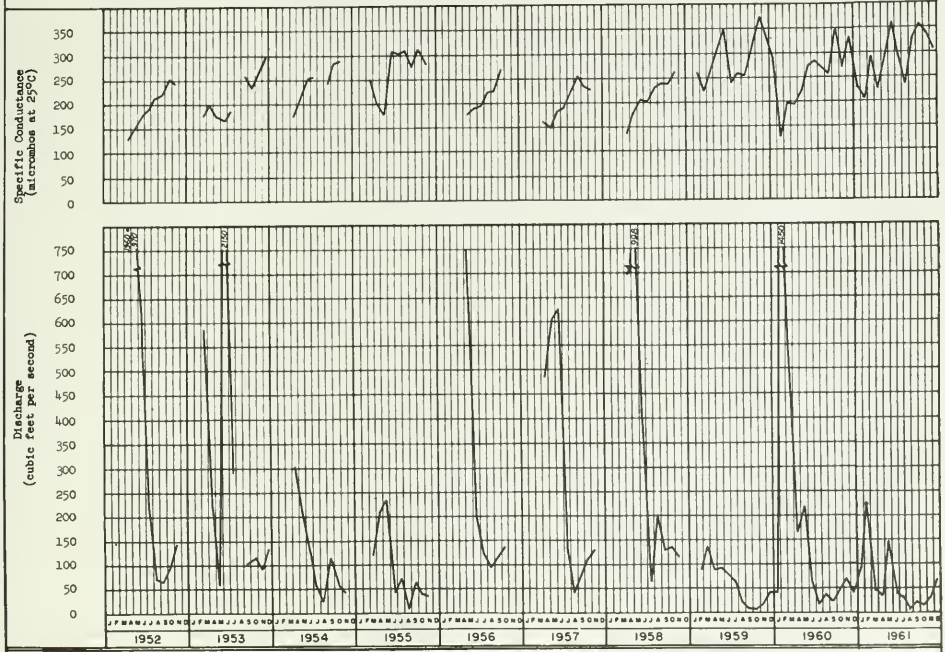
Water Quality Characteristics. Pit River at Station 17a is calcium-sodium bicarbonate, class 1 for irrigation, and soft to slightly hard. While iron occasionally exceeds the recommended maximum for iron and manganese combined in drinking water, all other minerals are within drinking water standards.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	376	124	355	204
Temperature in °F	79	33	79	34
Dissolved oxygen in parts per million	12.5	6.0	11.8	8.0
Percent saturation	108	68	108	74
pH	8.5	6.8	8.5	7.3
Mineral constituents in parts per million				
Calcium (Ca)	27	11	27	23
Magnesium (Mg)	11	4.4	9.6	9.4
Sodium (Na)	47	8.4	41	18
Potassium (K)	7.0	2.3	5.4	4.7
Carbonate (CO_3)	10	0.0	10	0.0
Bicarbonate (HCO_3)	192	66	186	106
Sulfate (SO_4)	25	4.9	23	12
Chloride (Cl)	20	0.0	12	2.1
Nitrate (NO_3)	2.2	0.0	1.3	0.9
Fluoride (F)	0.6	0.0	0.2	0.1
Boron (B)	0.3	0.0	0.3	0.0
Silica (SiO_2)	38	28	32	31
Total dissolved solids in parts per million	263	87	248	143
Percent sodium	52	26	51	35
Hardness as $CaCO_3$ in parts per million				
Total	115	44	115	64
Noncarbonate	0.0	0.0	0.0	0.0
Turbidity	600	3	100	10
Coliform in most probable number per milliliter	7,000. +	0.045 -	230.	0.045 -
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.31	0.00	0.31	0.19
Solid alpha	1.43	0.00	0.46	0.03
Dissolved beta	12.0	0.00	12.0	7.8
Solid beta	8.25	0.00	7.6	0.0

WATER QUALITY VARIATIONS



PIT RIVER NEAR CANBY (STA. NO. 17a)

PIT RIVER NEAR BIEBER (STA. 17e)

Sampling Point. Station 17e is located within Section 34 of Township 37 North, Range 7 East, Mt. Diablo Base and Meridian. Monthly water samples were collected from the right bank, at the USGS gage, 1.5 miles upstream from Spring Gulch and 8 miles south of Bieber. On occasion when the station is inaccessible, samples are collected at the Highway 299 bridge in Bieber.

Period of Record. October 1958 through December 1961.

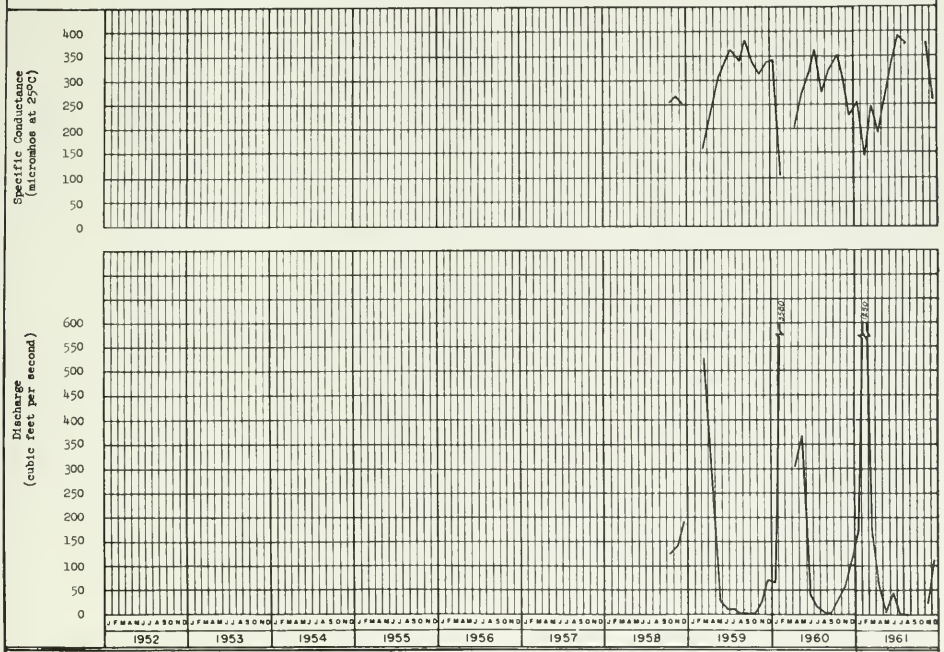
Water Quality Characteristics. Water at this station is generally sodium-calcium bicarbonate in character, class 1 for irrigation, soft to moderately hard, and within mineral standards for drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	389	104	389	145
Temperature in °F	77	32	77	34
Dissolved oxygen in parts per million	14.6	5.0	11.7	5.0
Percent saturation	174	55	92	55
pH	8.6	7.1	8.6	7.3
Mineral constituents in parts per million				
Calcium (Ca)	28	13	---	20
Magnesium (Mg)	12	3.3	9.2	---
Sodium (Na)	68	8.3	39	13
Potassium (K)	8.8	2.6	---	4.1
Carbonate (CO_3)	53	0.0	16	0.0
Bicarbonate (HCO_3)	218	42	214	76
Sulfate (SO_4)	40	3.0	---	3.0
Chloride (Cl)	23	0.9	12	0.9
Nitrate (NO_3)	1.3	0.0	0.9	---
Fluoride (F)	0.5	0.2	---	0.2
Boron (B)	0.3	0.0	0.2	0.0
Silica (SiO_2)	35	10	27	---
Total dissolved solids in parts per million	269	72	269	100
Percent sodium	68	12	47	28
Hardness as $CaCO_3$ in parts per million				
Total	177	35	123	45
Noncarbonate	1	0.0	0.0	0.0
Turbidity	500	2	300	10
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.33	0.00	---	0.08
Solid alpha	0.17	0.08	0.17	---
Dissolved beta	13.33	6.15	---	3.2
Solid beta	7.16	0.00	4.5	---

WATER QUALITY VARIATIONS



PIT RIVER NEAR BIEBER (STA. NO. 17e)

PIT RIVER NEAR MONTGOMERY CREEK (STA. 17)

Sampling Point. Station 17 is located in Section 32 of Township 35 North, Range 1 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, 0.1 to 0.2 mile upstream from Fenders Ferry Bridge. Occasionally backwater conditions exist at this station.

Period of Record. April 1951 through December 1961.

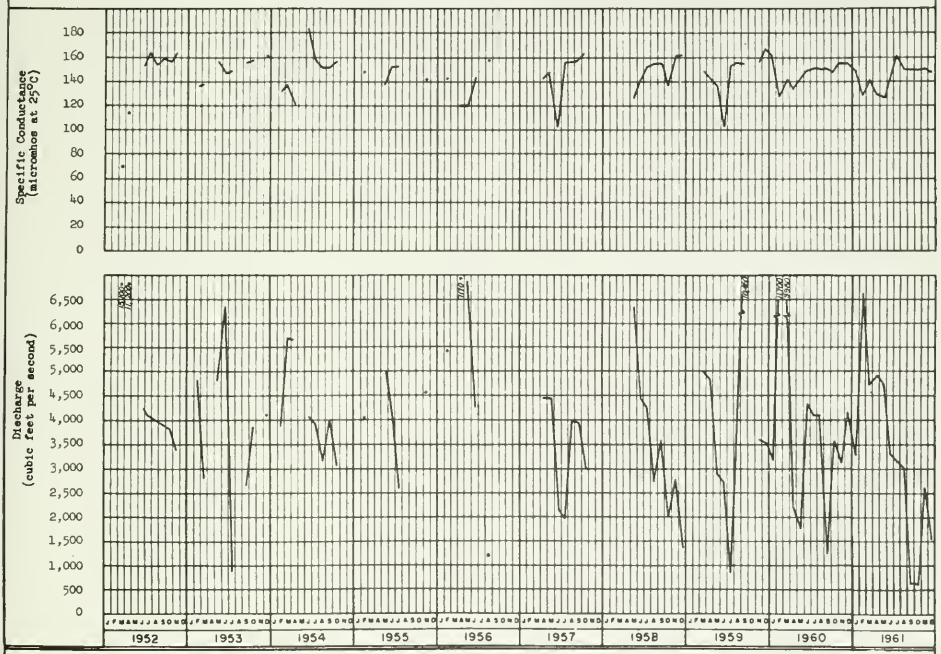
Water Quality Characteristics. Analyses showed the character of the water at Station 17 to be calcium-magnesium-sodium bicarbonate, class 1 for irrigation, soft to slightly hard, and within the recommended limits for mineral content in drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	183	70	161	127
Temperature in °F	71	36	70	44
Dissolved oxygen in parts per million	15.3	6.9	12.3	8.3
Percent saturation	130	73	101	90
pH	8.5	7.1	8.5	7.2
Mineral constituents in parts per million				
Calcium (Ca)	14	6.9	13	12
Magnesium (Mg)	7.3	2.3	5.7	4.9
Sodium (Na)	14	2.6	14	6.6
Potassium (K)	3.2	0.8	2.2	1.7
Carbonate (CO_3)	3	0.0	3	0.0
Bicarbonate (HCO_3)	98	44	91	75
Sulfate (SO_4)	4.8	0.9	2.0	2.0
Chloride (Cl)	8.5	0.2	5.8	0.2
Nitrate (NO_3)	1.0	0.0	0.6	0.0
Fluoride (F)	0.2	0.0	0.2	0.1
Boron (B)	0.3	0.0	0.2	0.0
Silica (SiO_2)	38	17	33	30
Total dissolved solids in parts per million	137	58	121	97
Percent sodium	35	15	35	22
Hardness as $CaCO_3$ in parts per million				
Total	74	32	61	48
Noncarbonate	3	0.0	0.0	0.0
Turbidity	70	0.5	35	3
Coliform in most probable number per milliliter	7,000. +	0.045 -	7,000.	0.045 -
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.38	0.00	0.38	0.0
Solid alpha	0.78	0.00	0.38	0.0
Dissolved beta	8.82	0.00	4.4	2.9
Solid beta	6.3	0.00	6.3	3.8

WATER QUALITY VARIATIONS



PIT RIVER NEAR MONTGOMERY CREEK (STA. NO. 17)

PIT RIVER, SOUTH FORK NEAR LIKELY (STA. 18a)

Sampling Point. Station 18a is the upstream station on the Pit River Basin and is located in Section 11 of Township 39 North, Range 13 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank, at the USGS gage, 1.3 miles downstream from West Valley Creek and 3.5 miles east of Likely.

Period of Record. August 1958 through December 1961.

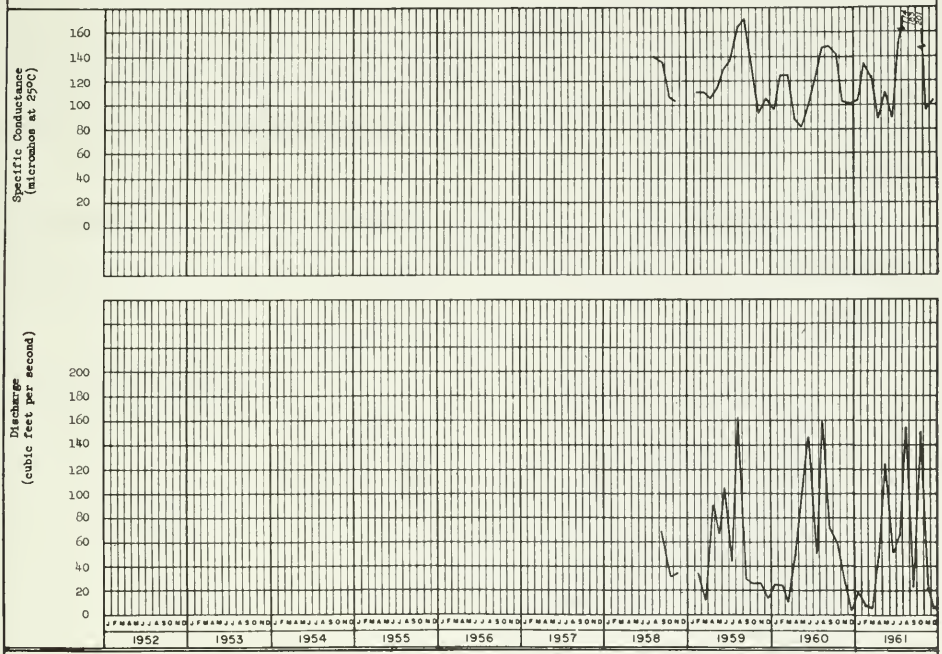
Water Quality Characteristics. South Fork Pit River near Likely is calcium-magnesium bicarbonate in character, class 1 for irrigation, and soft to slightly hard. Although it meets drinking water standards for mineral content, iron concentrations occasionally exceed the recommended limit of 0.3 ppm for iron and manganese combined.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	201	82.8	201	87
Temperature in °F	78	32	71	32
Dissolved oxygen in parts per million	12.2	7.3	11.7	7.4
Percent saturation	97	69	90	69
pH	8.5	7.3	8.5	7.3
Mineral constituents in parts per million				
Calcium (Ca)	16	8.4	16	9.2
Magnesium (Mg)	6.3	2.2	6.3	4.4
Sodium (Na)	14	3.6	14	3.6
Potassium (K)	4.7	1.9	4.4	2.4
Carbonate (CO_3)	4.0	0.0	4.0	0.0
Bicarbonate (HCO_3)	106	46	106	49
Sulfate (SO_4)	9.0	0.0	9.0	1.6
Chloride (Cl)	7.5	0.0	4.5	0.0
Nitrate (NO_3)	1.6	0.0	0.8	0.6
Fluoride (F)	0.3	0.0	0.1	0.1
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	40	30	38	33
Total dissolved solids in parts per million	137	72	174	75
Percent sodium	34	17	34	18
Hardness as $CaCO_3$ in parts per million				
Total	70	30	70	36
Noncarbonate	3	0.0	0.0	0.0
Turbidity	75	1	75	2
Coliform in most probable number per milliliter	7,000. +	0.045 -	7,000. +	0.045 -
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.51	0.0	0.17	0.0
Solid alpha	0.76	0.0	0.44	0.0
Dissolved beta	9.32	2.1	3.55	2.1
Solid beta	1.72	0.00	1.3	0.0

WATER QUALITY VARIATIONS



PIT RIVER, SOUTH FORK NEAR LIKELY (STA. NO. 18a)

Redding Stream Unit

The Redding stream unit is located on the northern extremity of Sacramento Valley and includes all major streams tributary to Sacramento River between Keswick Dam and Red Bluff. To the west of the Sacramento River, Cottonwood and Clear Creeks are the major tributaries, and Cow, Bear, Battle, and Paynes Creeks contribute from the east. The unit drains an area of about 2,610 square miles of which 780 square miles is valley and mesa land. Mean annual runoff in the unit totals 2,740,000 acre-feet.

The terrain of the unit is comprised of a fertile valley floor, rolling grass-covered foothills, and rugged mountains at the eastern and western boundaries. Developments in this area are centered around agriculture and lumbering activities. Livestock raising, recreation, and light industry are also prevalent in the unit. The Sacramento River and the underlying ground water basin provide most of the water used in the unit.

Waste discharges of significant quantity in this unit include outflows from United States Plywood Corporation (.34 mgd) and Anderson Sanitation District (.75 mgd).

The following tabulation presents the names of stations maintained to monitor quality of surface water in this basin, and the page on which each is discussed:

Monitoring Station	Page Number of Station Discussion
Clear Creek near Igo	182
Cow Creek near Millville	184
Cottonwood Creek below North Fork Cottonwood Creek	186
Cottonwood Creek near Cottonwood	188
Cottonwood Creek, South Fork above Cottonwood Creek	190
Battle Creek near Cottonwood	192
Paynes Creek near Red Bluff	194

CLEAR CREEK NEAR IGO (STA. 12d)

Sampling Point. Station 12d is located in Section 27, Township 31 North, Range 6 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank at the Redding-Igo road bridge, 1.0 mile northeast of Igo, 8 miles southwest of Redding, and 10.5 miles upstream from the mouth of the creek.

Period of Record. April 1958 through December 1961.

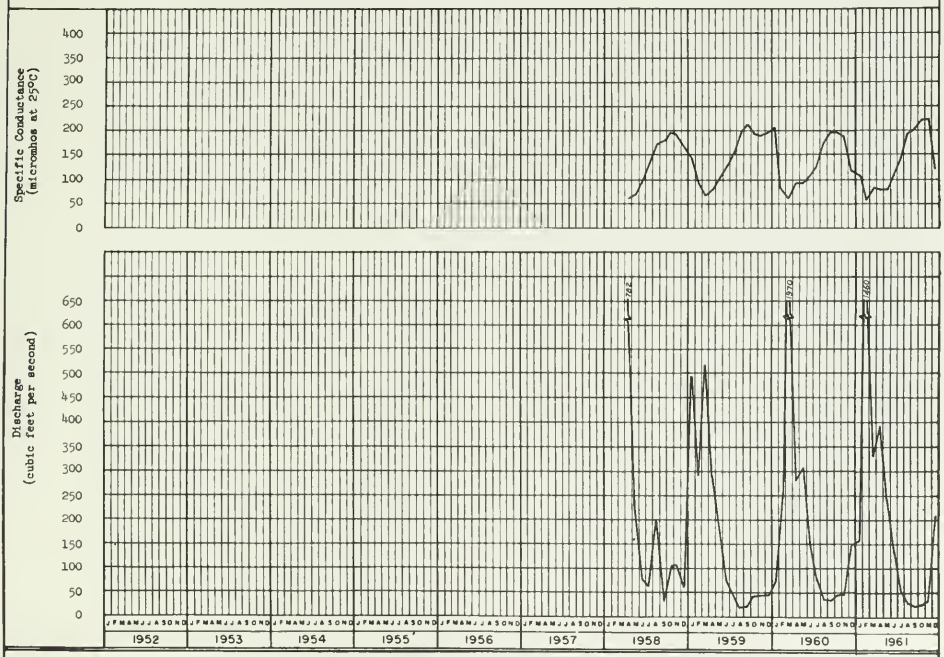
Water Quality Characteristics. A review of past analyses show the water at Station 12d to be bicarbonate in type with calcium the predominant cation, soft to slightly hard, and meets the drinking water standards for mineral content. Mineral concentrations in this water identify it as class 1 for irrigation.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	220	57.8	220	63.3
Temperature in °F	83	36	83	43
Dissolved oxygen in parts per million	13.4	6.5	11.8	8.1
Percent saturation	116	74	103	86
pH	9.3	6.9	8.7	7.1
Mineral constituents in parts per million				
Calcium (Ca)	19	6.4	19	10
Magnesium (Mg)	5.6	1.8	3.5	2.1
Sodium (Na)	18	2.6	15	3.0
Potassium (K)	1.6	0.3	1.6	0.7
Carbonate (CO_3)	8	0.0	8	0.0
Bicarbonate (HCO_3)	75	24	73	26
Sulfate (SO_4)	17	1.9	9.0	7.0
Chloride (Cl)	29	0.5	22	0.5
Nitrate (NO_3)	1.7	0.0	0.4	0.2
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.13	0.0	0.0	0.0
Silica (SiO_2)	23	12	17	14
Total dissolved solids in parts per million	141	37	141	41
Percent sodium	37	19	34	20
Hardness as $CaCO_3$ in parts per million				
Total	78	24	78	26
Noncarbonate	21	0.0	9	0.0
Turbidity	100	0.3	100	0.3
Coliform in most probable number per milliliter (Not measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.58	0.09	0.30	0.14
Solid alpha	0.47	0.09	0.23	0.14
Dissolved beta	23.21	0.00	1.2	0.5
Solid beta	6.54	0.0	3.6	0.0

WATER QUALITY VARIATIONS



CLEAR CREEK NEAR IGO (STA. NO. 12d)

COW CREEK NEAR MILLVILLE (STA. 88a)

Sampling Point. The sampling station is located in Section 32 of Township 31 North, Range 3 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, at the USGS gage, 4.2 miles southwest of Millville, and 4.3 miles downstream from Little Cow Creek.

Period of Record. April 1958 through December 1961.

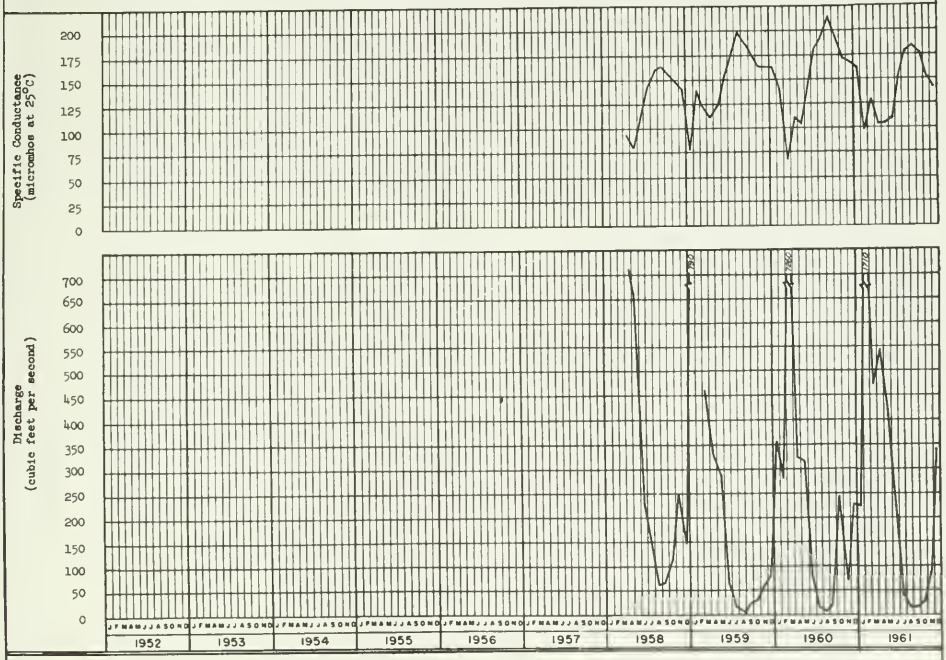
Water Quality Characteristics. Analyses show water at Station 88a to be a calcium bicarbonate type, soft to slightly hard, class 1 for irrigation, and meets the drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	215	65.7	182	98.9
Temperature in °F	90	38	90	46
Dissolved oxygen in parts per million	12.7	6.1	11.8	6.5
Percent saturation	128	71	126	82
pH	8.3	6.8	8.3	7.1
Mineral constituents in parts per million				
Calcium (Ca)	20	7.2	19	10
Magnesium (Mg)	8.3	2.9	6.8	4.1
Sodium (Na)	13	2.6	9.6	4.2
Potassium (K)	2.2	0.6	1.8	0.9
Carbonate (CO_3)	2	0.0	2	0.0
Bicarbonate (HCO_3)	120	31	100	45
Sulfate (SO_4)	12	0.6	4.4	1.0
Chloride (Cl)	14	1.4	9.4	2.0
Nitrate (NO_3)	1.1	0.0	1.1	0.0
Fluoride (F)	0.2	0.0	0.2	0.0
Boron (B)	0.30	0.0	0.2	0.0
Silica (SiO_2)	37	18	35	26
Total dissolved solids in parts per million	154	48	129	72
Percent sodium	25	17	23	18
Hardness as $CaCO_3$ in parts per million				
Total	84	26	75	41
Noncarbonate	15	0.0	12	0.0
Turbidity	425	1	13	1
Coliform in most probable number per milliliter (Not measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.57	0.00	0.57	0.0
Solid alpha	0.60	0.00	0.0	0.00
Dissolved beta	5.84	0.00	3.4	0.0
Solid beta	4.9	0.00	4.9	0.0

WATER QUALITY VARIATIONS



COW CREEK NEAR MILLVILLE (STA. NO. 88a)

COTTONWOOD CREEK BELOW NORTH FORK COTTONWOOD CREEK (STA. 11a)

Sampling Point. The monitoring station is located in Section 2, Township 29 North, Range 6 West, Mt. Diablo Base and Meridian. Monthly water samples were collected from the left bank, 13.5 miles west of the town of Cottonwood along Gas Point Road about 1.0 mile downstream from the mouth of North Fork Cottonwood Creek.

Period of Record. October 1958 through December 1961.

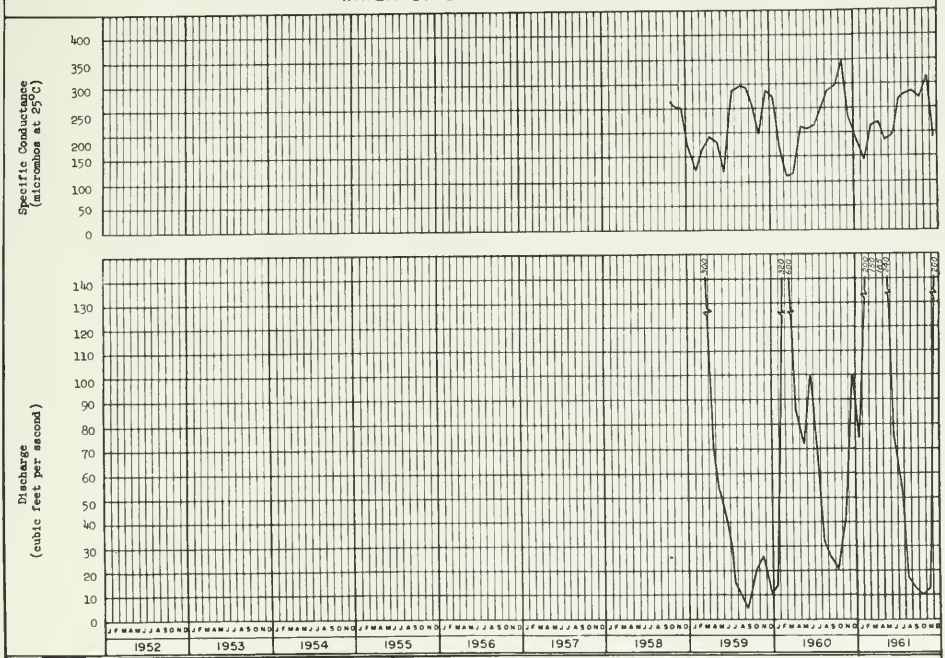
Water Quality Characteristics. Water at Station 11a is calcium-magnesium bicarbonate in character, slightly to moderately hard, class 1 for irrigation, and meets drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	347	105	315	147
Temperature in °F	90	33	90	43
Dissolved oxygen in parts per million	13.1	6.6	11.6	7.1
Percent saturation	132	77	119	92
pH	8.4	7.1	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	30	11	29	20
Magneeium (Mg)	15	3.9	13	9.5
Sodium (Na)	14	3.9	12	4.9
Potaesium (K)	2.6	0.4	1.4	0.8
Carbonate (CO_3)	9	0.0	4	0.0
Bicarbonate (HCO_3)	162	33	151	58
Sulfate (SO_4)	27	4.8	8.0	7.0
Chloride (Cl)	24	2.2	19	2.2
Nitrate (NO_3)	3.5	0.0	0.2	0.1
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	24	11	22	19
Total dissolved solids in parts per million	218	66	198	92
Percent sodium	30	9	18	11
Hardness as $CaCO_3$ in parte per million				
Total	152	46	137	62
Noncarbonate	29	0.0	14	0.0
Turbidity	450	1	40	2
Coliform in most probeble number per milliliter	(Not Measured)			
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.34	0.0	0.24	0.0
Solid elpha	0.82	0.16	0.24	0.16
Dissolved beta	12.9	0.00	12.9	0.0
Solid beta	12.6	1.3	12.6	1.4

WATER QUALITY VARIATIONS



COTTONWOOD CREEK BELOW NORTH FORK COTTONWOOD CREEK (STA. NO. 11a)

COTTONWOOD CREEK NEAR COTTONWOOD (STA. 12b)

Sampling Point. Station 12b is located in Section 7 of Township 29 North, Range 3 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the USGS gage 2 miles east of the town of Cottonwood, and approximately 2.5 miles upstream from the mouth.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Water at Station 12b is calcium bicarbonate type, class 1 for irrigation, slightly to moderately hard, meets drinking water standards for mineral content, and is suitable for nearly all industrial uses.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	389	89.1	246	176
Temperature in °F	84	40	77	48
Dissolved oxygen in parts per million	13.9	6.7	11.1	8.1
Percent saturation	147	71	125	85
pH	8.3	6.8	8.3	7.2
Mineral constituents in parts per million				
Calcium (Ca)	37	8.1	20	16
Magnesium (Mg)	14	5.1	8.8	8.5
Sodium (Na)	18	2.9	11	6.6
Potassium (K)	2.7	0.7	1.4	1.3
Carbonate (CO_3)	3	0.0	1	0.0
Bicarbonate (HCO_3)	148	47	145	96
Sulfate (SO_4)	13	4.0	8.0	5.0
Chloride (Cl)	37	0.6	16	3.2
Nitrate (NO_3)	9.1	0.1	0.5	0.4
Fluoride (F)	0.3	0.0	0.1	0.1
Boron (B)	0.20	0.0	0.1	0.0
Silica (SiO_2)	28	18	28	22
Total dissolved solids in parts per million	228	52	144	103
Percent sodium	28	10	20	14
Hardness as $CaCO_3$ in parts per million				
Total	150	41	122	75
Noncarbonate	29	0.0	16	0.0
Turbidity	600	0.0	40	2
Coliform in most probable number per milliliter	7,000. +	0.046	620.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.18	0.00	0.30	0.0
Solid alpha	0.89	0.00	0.22	0.08
Dissolved beta	4.2	0.00	3.8	0.0
Solid beta	10.7	0.00	6.2	4.8

WATER QUALITY VARIATIONS

COTTONWOOD CREEK NEAR COTTONWOOD (STA. NO. 12b)

COTTONWOOD CREEK, SOUTH FORK ABOVE COTTONWOOD CREEK (STA. 11b)

Sampling Point. The station is located in Section 17, Township 29 North, Range 4 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at mid-stream from the Evergreen Road bridge, approximately 3.2 miles west of State Highway 99, and 1 mile upstream from the mouth.

Period of Record. November 1958 through December 1961.

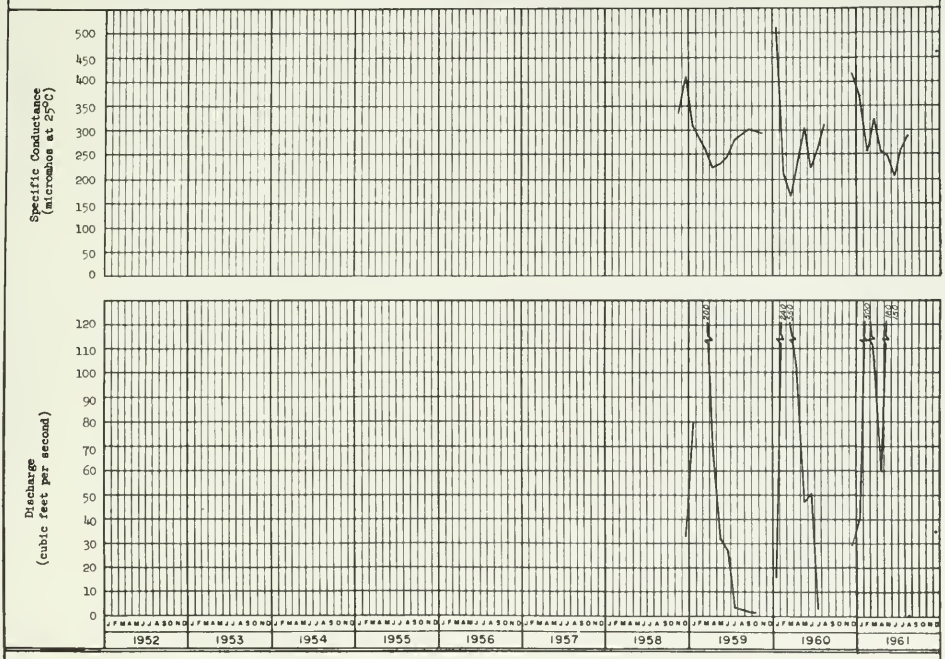
Water Quality Characteristics. Water at this station is calcium bicarbonate in character, slightly to moderately hard, and class 1 for irrigation. The water is suitable for most industrial purposes, and meets drinking water requirements for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	520	164	460	202
Temperature in °F	92	38	92	38
Diseolved oxygen in parts per million	13.0	5.3	13.0	6.4
Percent saturation	112	54	112	88
pH	8.4	7.1	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	43	23	---	28
Magnesium (Mg)	15	7.7	---	8.6
Sodium (Na)	28	6.0	26	9.2
Potassium (K)	2.0	0.5	---	0.8
Carbonate (CO_3)	5	0.0	5	0.0
Bicarbonate (HCO_3)	191	80	174	100
Sulfate (SO_4)	32	7.9	---	13
Chloride (Cl)	81	6.2	56	8.2
Nitrate (NO_3)	0.5	0.0	---	0.0
Fluoride (F)	0.2	0.0	---	0.1
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	22	10	---	10
Total dissolved solids in parts per million	354	112	314	138
Percent sodium	25	15	25	17
Hardness as $CaCO_3$ in parts per million				
Total	204	72	173	84
Noncarbonate	90	0.0	61	0.0
Turbidity	700	1	30	1
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.15	0.00	0.15	---
Solid alpha	0.47	0.09	---	0.16
Dissolved beta	3.30	0.4	---	0.4
Solid beta	5.4	0.98	5.4	---

WATER QUALITY VARIATIONS



COTTONWOOD CREEK, SOUTH FORK ABOVE COTTONWOOD CREEK (STA. NO. 11b)

BATTLE CREEK NEAR COTTONWOOD (STA. 88b)

Sampling Point. Station 88b is located in Section 6, Township 29 North, Range 2 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected on the right bank at the USGS gaging station, 6.3 miles upstream from the mouth, and 7.6 miles east of Cottonwood.

Period of Record. April 1958 through December 1961.

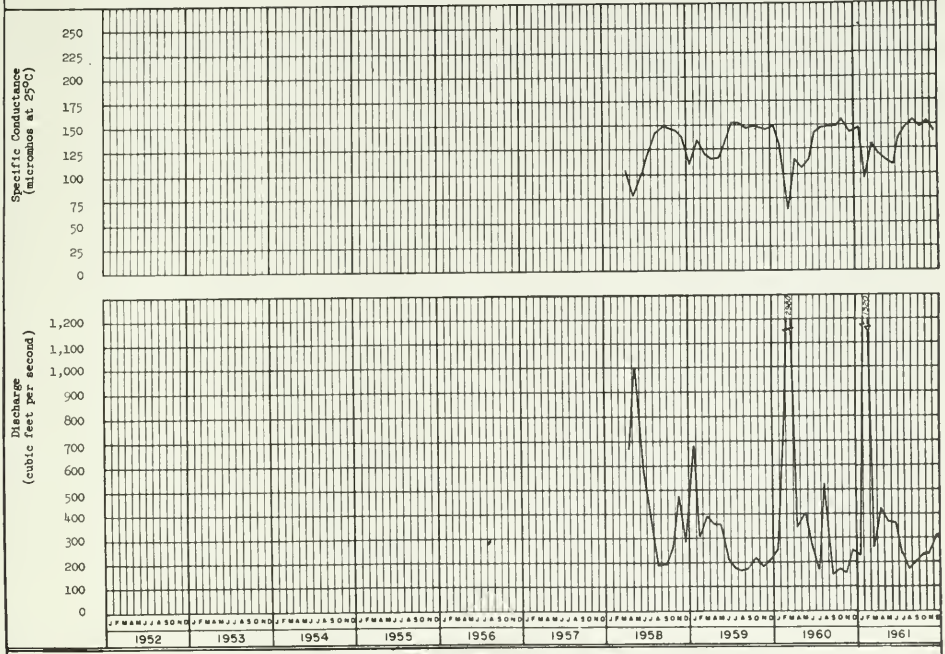
Water Quality Characteristics. The water at Station 88b is bicarbonate in type with magnesium the predominant cation, excellent in quality, class 1 for irrigation, soft to slightly hard, and meets the requirements for drinking water. Mineral concentrations in water at Station 88b do not vary appreciably due to the effects of controlled flow resulting from upstream power developments.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	154	67.6	153	95
Temperature in °F	72	42	65	43
Dissolved oxygen in parts per million	12.6	6.3	11.6	8.4
Percent sturation	109	59	109	82
pH	8.4	7.0	8.4	7.1
Mineral constituents in parts per million				
Calcium (Ca)	12	6.0	10	9.2
Magnesium (Mg)	7.5	3.6	7.5	4.9
Sodium (Na)	16	2.7	8.7	4.2
Potassium (K)	2.6	1.3	2.2	1.8
Carbonate (CO_3)	1	0.0	1	0.0
Bicarbonate (HCO_3)	95	29	90	51
Sulfate (SO_4)	6.7	0.0	1.0	1.0
Chloride (Cl)	8.5	0.5	3.5	1.0
Nitrate (NO_3)	1.3	0.0	0.1	0.1
Fluoride (F)	0.2	0.0	0.2	0.1
Boron (B)	0.20	0.0	0.1	0.0
Silica (SiO_2)	53	30	47	40
Total dissolved solids in parts per million	134	59	133	83
Percent sodium	39	19	27	19
Hardness as $CaCO_3$ in parts per million				
Total	82	26	59	38
Noncarbonate	24	0.0	0.0	0.0
Turbidity	125	1	20	1
Coliform in most probable number per milliliter (Not measured)				
Radioactivity in micro-micro curise per liter				
Disolved alpha	0.36	0.00	0.08	0.0
Solid alpha	0.60	0.09	0.57	0.0
Dissolved beta	14.94	2.59	2.3	0.0
Solid beta	5.7	0.00	5.7	0.0

WATER QUALITY VARIATIONS



BATTLE CREEK NEAR COTTONWOOD (STA. NO. 88b)

PAYNES CREEK NEAR RED BLUFF (STA. 88g)

Sampling Point. Red Bluff station is located in Section 3 of Township 28 North, Range 2 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, 100 yards upstream from Long Road bridge at Dales station, approximately 14 miles east of Red Bluff, and 7 miles upstream from the USGS gage.

Period of Record. October 1958 through December 1961.

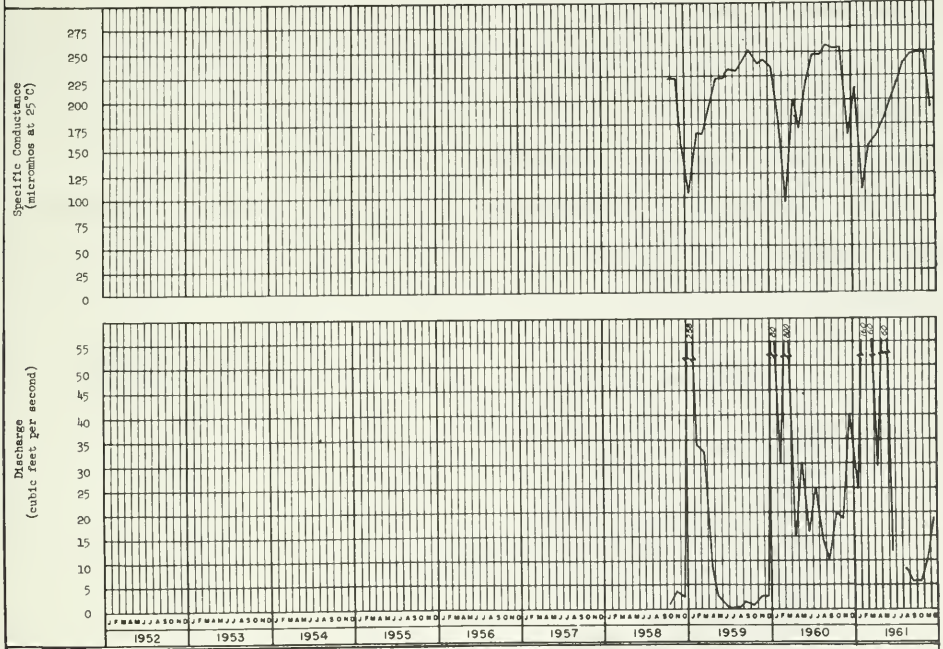
Water Quality Characteristics. Past analyses show water at this point to be bicarbonate in type with no predominant cation, slightly hard, and within drinking water standards. Boron concentrations occasionally cause the water to be class 2 for irrigation. Boron in this stream is attributable to the geologic formations in the drainage basin.

Significant Water Quality Changes. For several months during 1960 and 1961, boron concentrations exceeded the limits of a class 1 irrigation water. This was due to low flow conditions which existed.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	255	94.8	248	110
Temperature in °F	75	43	70	48
Dissolved oxygen in parts per million	11.9	7.6	11.3	8.5
Percent saturation	111	80	106	88
pH	8.4	7.0	8.4	7.2
Mineral constituents in parts per million				
Calcium (Ca)	17	7.2	15	12
Magnesium (Mg)	12	4.4	12	7.8
Sodium (Na)	24	4.5	21	5.9
Potassium (K)	2.8	1.1	1.4	1.4
Carbonate (CO_3)	2	0.0	2	0.0
Bicarbonate (HCO_3)	136	42	122	57
Sulfate (SO_4)	16	0.0	2.0	0.0
Chloride (Cl)	20	2.8	19	2.8
Nitrate (NO_3)	5.0	0.0	1.0	0.3
Fluoride (F)	0.3	0.0	0.3	0.1
Boron (B)	0.6	0.0	0.6	0.0
Silica (SiO_2)	53	14	48	14
Total dissolved solids in parts per million	195	73	192	85
Percent sodium	38	22	36	24
Hardness as $CaCO_3$ in parts per million				
Total	89	36	85	41
Noncarbonate	2	0.0	0.0	0.0
Turbidity	70	1	10	2
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Diseolved alpha	0.50	0.00	0.31	0.12
Solid alpha	0.38	0.00	0.0	0.00
Diasolved beta	12.05	0.00	2.3	0.0
Solid bete	5.4	0.00	5.4	0.0

WATER QUALITY VARIATIONS



PAYNES CREEK NEAR RED BLUFF (STA. NO. 88g)

West Side Stream Unit

The drainage area of the West Side Stream Unit occupies approximately 4,000 square miles along the west side of Sacramento Valley. Major streams draining the area include Redbank, Elder, Thomes, Stony, Cache, and Putah Creeks. Clear Lake is a large natural lake on Cache Creek and is a prominent feature of the drainage area. Foothills and mountains of the Coast Range cover about 75 percent of the unit. The aggregate natural runoff of the streams of the unit average about 1,900,000 acre-feet per year.

Commercial development in the unit is primarily based on agriculture and livestock raising. The foothills provide excellent grazing lands and the valley and mesa lands are suitable for numerous orchard and field crops. Recreation has been a major attraction in the Clear Lake area for many years and, as water developments occur in other portions of this unit, recreation will command a more important place in their economy.

Several small communities, resort areas, and limited mining activities discharge wastes into the streams of this unit. Only minor impairment of water quality in these streams is attributable to this source.

The following tabulation presents the names of stations maintained to monitor quality of surface water in this unit and the page on which each is discussed:

Monitoring Station	Page Number of Station Discussion
Redbank Creek near Red Bluff	198
Elder Creek near Paskenta	200
Elder Creek at Gerber	202
Thomes Creek at Paskenta	204
Thomes Creek near mouth	206
Stony Creek at Black Butte Dam Site	208
Stony Creek near Hamilton City	210
Clear Lake at Lakeport	212
Cache Creek near Lower Lake	214
Cache Creek near Capay	216
Cache Creek, North Fork near Lower Lake	218
Putah Creek near Winters	220

RED BANK CREEK NEAR RED BLUFF (STA. 88d)

Sampling Point. Station 88d is situated in Section 22 of Township 26 North, Range 5 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at private bridge approximately 100 feet north of Lowery Road, at the DWR gage, 2 miles southeast of Red Bank and 15 miles northwest of Red Bluff.

Period of Record. January 1959 through December 1961.

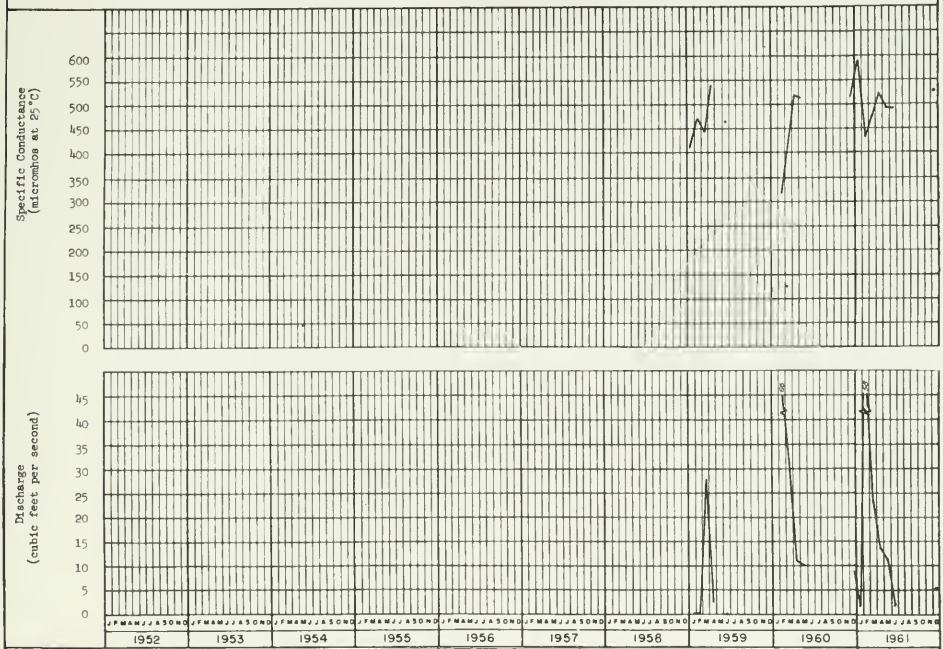
Water Quality Characteristics. Water at Station 88d is calcium-magnesium bicarbonate in character, class 1 for irrigation, very hard, and within drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	578	316	578	432
Temperature in °F	82	38	82	38
Dissolved oxygen in parts per million	13.5	8.7	12.1	8.7
Percent saturation	142	88	125	88
pH	8.5	7.4	8.5	7.5
Mineral constituents in parts per million				
Calcium (Ca)	61	32	61	47
Magnesium (Mg)	29	15	29	22
Sodium (Na)	19	11	19	14
Potassium (K)	1.7	0.2	0.9	0.2
Carbonate (CO_3)	10	0.0	8	0.0
Bicarbonate (HCO_3)	268	131	268	198
Sulfate (SO_4)	72	35	72	47
Chloride (Cl)	30	6.0	30	6.0
Nitrate (NO_3)	5.5	0.0	1.9	0.0
Fluoride (F)	0.4	0.0	0.1	0.0
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	23	11	20	11
Total dissolved solids in parts per million	346	189	346	264
Percent sodium	14	12	14	13
Hardness as $CaCO_3$ in parts per million				
Total	271	141	271	210
Noncarbonate	86	20	86	30
Turbidity	8	2	8	2
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.32	0.0	0.32	---
Solid alpha	0.32	0.00	---	0.00
Dissolved beta	1.31	0.0	---	0.0
Solid beta	8.3	1.52	8.3	---

WATER QUALITY VARIATIONS



RED BANK CREEK NEAR RED BLUFF (STA. NO. 88d)

ELDER CREEK NEAR PASKENTA (STA. 13e)

Sampling Point. The location of Station 13e is within Section 14 of Township 25 North, Range 6 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank, at the USGS gage, 2.5 miles downstream from South Fork, 8 miles northeast of Fluornoy, and 11 miles north of Paskenta.

Period of Record. October 1958 through December 1961.

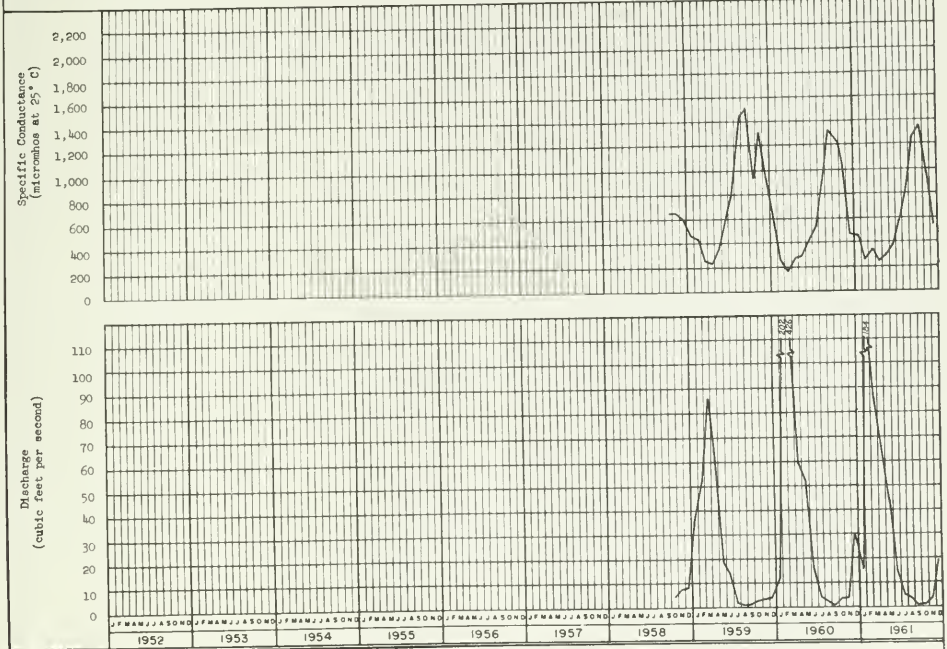
Water Quality Characteristics. Analyses of samples show the water at Station 13e to be a calcium or magnesium bicarbonate type changing to sodium chloride at low flows. The water is moderately to very hard, but within drinking water standards for mineral content. Occasionally, conductivity causes the water at Station 13e to be class 2 for irrigation.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,520	170	1,360	266
Temperature in °F	89	41	82	41
Dissolved oxygen in parts per million	13.0	7.0	12.2	7.0
Percent saturation	119	78	103	78
pH	8.6	7.5	8.6	7.5
Mineral constituents in parts per million				
Calcium (Ca)	69	21	49	26
Magnesium (Mg)	51	12	39	19
Sodium (Na)	182	4.3	146	8.5
Potassium (K)	3.6	0.4	1.8	0.8
Carbonate (CO_3)	11	0.0	8.0	0.0
Bicarbonate (HCO_3)	244	90	224	128
Sulfate (SO_4)	30	1.9	9.8	8.0
Chloride (Cl)	408	4.5	342	6.5
Nitrate (NO_3)	5.9	0.0	0.4	0.0
Fluoride (F)	0.2	0.0	0.2	0.0
Boron (B)	0.3	0.0	0.2	0.0
Silica (SiO_2)	24	14	14	14
Total dissolved solids in parts per million	779	90	724	142
Percent sodium	57	10	50	12
Hardness as $CaCO_3$ in parts per million				
Total	383	103	314	127
Noncarbonate	279	1	170	1
Turbidity	600	0.9	15	0.9
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.68	0.09	0.25	0.22
Solid alpha	0.27	0.00	0.75	0.0
Dissolved beta	8.52	0.00	0.15	0.0
Solid beta	7.3	0.0	7.8	0.0

WATER QUALITY VARIATIONS



ELDER CREEK NEAR PASKENTA (STA. NO. 13e)

ELDER CREEK AT GERBER (STA. 95a)

Sampling Point. Elder Creek station is located within Saucos Grant in Section 2 of Township 25 North, Range 3 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, at the USGS gage, 3.5 miles upstream from the mouth, and 1.0 mile west of Gerber.

Period of Record. January 1959 through December 1961.

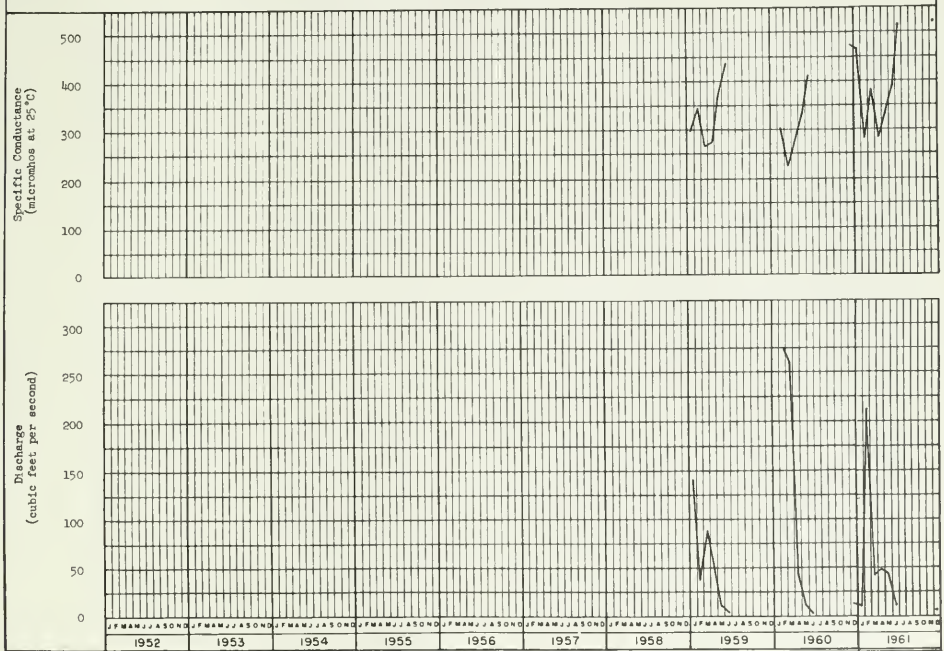
Water Quality Characteristics. The water is bicarbonate in character with calcium and magnesium the predominant cations, class 1 for irrigation, moderately hard, and within acceptable limits for mineral content in drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	519	221	519	281
Temperature in °F	84	40	84	46
Dissolved oxygen in parts per million	11.9	7.3	11.7	7.8
Percent saturation	104	84	102	91
pH	8.5	7.4	8.5	7.7
Mineral constituents in parts per million				
Calcium (Ca)	36	20	30	---
Magnesium (Mg)	27	11	---	19
Sodium (Na)	26	7.5	26	9.2
Potassium (K)	1.6	0.6	---	0.8
Carbonate (CO_3)	10	0.0	5	0.0
Bicarbonate (HCO_3)	264	101	264	141
Sulfate (SO_4)	23	4.8	---	12
Chloride (Cl)	51	8.5	51	8.5
Nitrate (NO_3)	7.6	0.0	---	0.0
Fluoride (F)	0.2	0.0	---	0.1
Boron (B)	0.2	0.0	0.1	0.0
Silica (SiO_2)	24	10	---	17
Total dissolved solids in parts per million	299	140	299	162
Percent sodium	21	14	21	15
Hardness as $CaCO_3$ in parts per million				
Total	242	99	242	117
Noncarbonate	53	0	53	0
Turbidity	100	0.0	100	1
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.38	0.15	0.38	---
Solid alpha	0.54	0.15	0.54	---
Dissolved beta	4.2	0.56	4.2	---
Solid beta	5.3	0.80	5.3	---

WATER QUALITY VARIATIONS



ELDER CREEK AT GERBER (STA. NO. 95a)

THOMES CREEK AT PASKENTA (STA. 13d)

Sampling Point. Station 13d is located in Section 4 of Township 23 North, Range 6 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank, at the USGS gage, 0.25 mile upstream from Digger Creek and 0.3 mile upstream from the highway bridge at Paskenta.

Period of Record. October 1958 through December 1961.

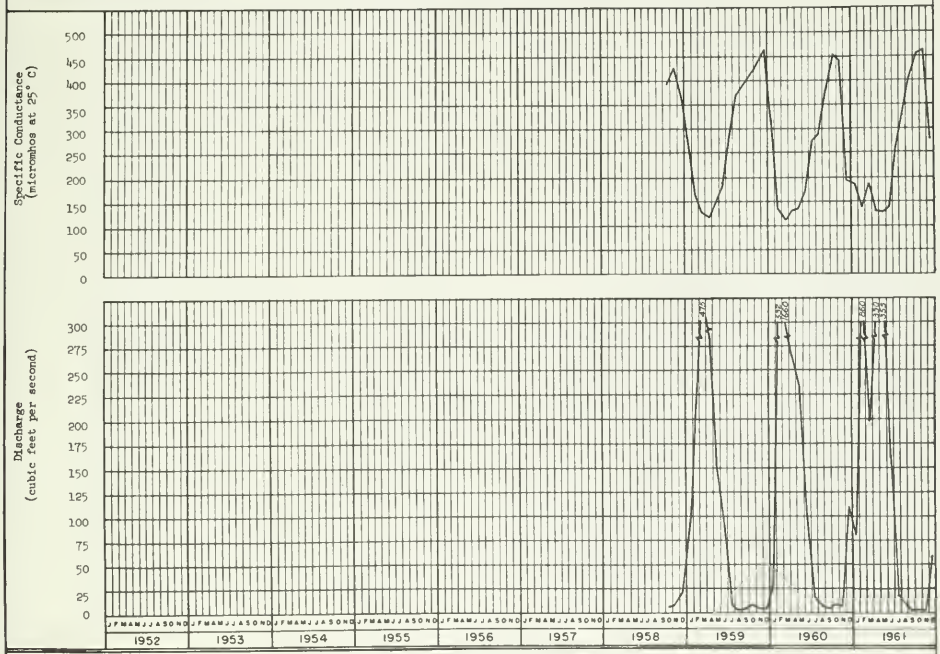
Water Quality Characteristics. Analyses showed the water at this station to be calcium bicarbonate in character, class 1 for irrigation, soft to moderately hard, and within drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	469	105	469	125
Temperature in °F	87	41	82	41
Dissolved oxygen in parts per million	12.9	7.2	12.5	7.2
Percent saturation	127	86	122	86
pH	8.5	7.3	8.5	7.4
Mineral constituents in parts per million				
Calcium (Ca)	52	4.6	17	4.6
Magnesium (Mg)	20	3.0	14	3.0
Sodium (Na)	23	2.1	20	3.3
Potassium (K)	2.0	0.3	1.3	0.7
Carbonate (CO_3)	7	0.0	7	0.0
Bicarbonate (HCO_3)	188	54	180	66
Sulfate (SO_4)	49	3.8	32	7.2
Chloride (Cl)	43	0.2	40	0.2
Nitrate (NO_3)	0.6	0.0	0.0	0.0
Fluoride (F)	0.3	0.0	0.2	0.0
Boron (B)	0.3	0.0	0.2	0.0
Silica (SiO_2)	17	8.2	8.9	8.2
Total dissolved solids in parts per million	279	63	279	73
Percent sodium	22	8	18	10
Hardness as $CaCO_3$ in parts per million				
Total	198	52	198	55
Noncerbonate	80	1	54	1
Turbidity	1,000	1	400	1
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.58	0.00	0.28	0.16
Solid alpha	0.60	0.00	0.55	0.24
Diesolved beta	5.29	0.0	2.1	0.0
Solid beta	9.27	0.0	6.0	0.0

WATER QUALITY VARIATIONS



THOMES CREEK AT PASKENTA (STA. NO. 13d)

THOMES CREEK NEAR MOUTH (STA. 95b)

Sampling Point. Thomes Creek station is located in Section 35 of Township 25 North, Range 3 West, Mt. Diablo Base and Meridian. Monthly water samples were collected from the center of the channel of flow beneath the Highway 99W bridge at Richfield, 3 miles north of Corning, 14.5 miles south of Red Bluff, and 4.5 miles upstream from the mouth.

Period of Record. January 1959 through December 1961.

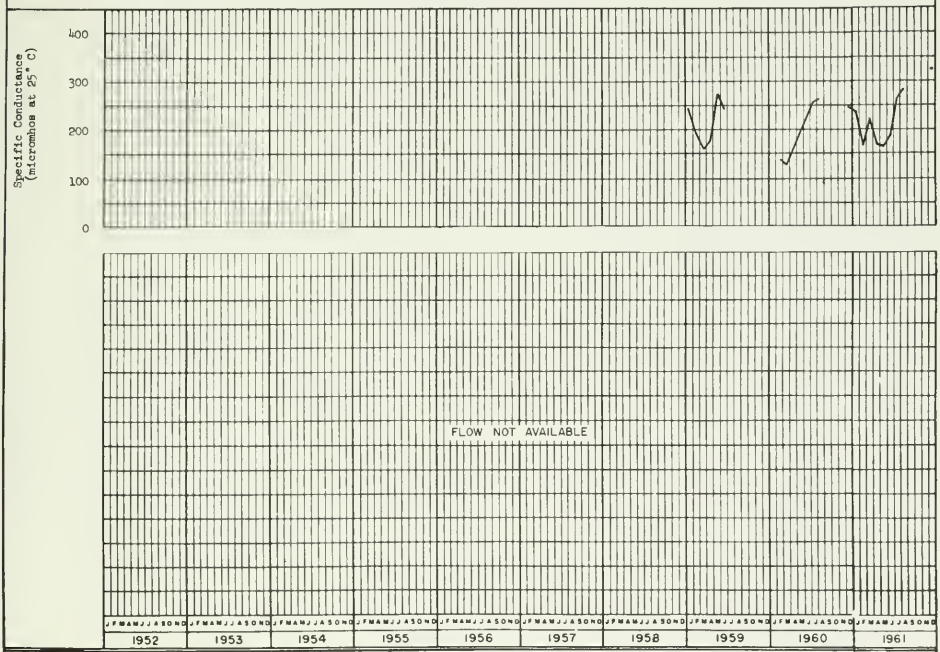
Water Quality Characteristics. Water at Station 95b is calcium bicarbonate in character, class 1 for irrigation, soft to moderately hard, and within the recommended standards for mineral content in drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	323	127	323	161
Temperature in °F	84	40	84	48
Dissolved oxygen in parts per million	12.1	5.9	11.5	7.3
Percent saturation	128	65	128	94
pH	8.4	7.3	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	33	16	---	23
Magnesium (Mg)	12	3.0	---	5.2
Sodium (Na)	9.3	3.1	8.6	3.7
Potassium (K)	1.7	0.3	---	0.6
Carbonate (CO_3)	3	0.0	3	0.0
Bicarbonate (HCO_3)	150	56	141	84
Sulfate (SO_4)	30	7.0	---	11
Chloride (Cl)	13	1.6	13	2.8
Nitrate (NO_3)	6.5	0.0	---	0.0
Fluoride (F)	0.4	0.0	---	0.2
Boron (B)	0.2	0.0	0.1	0.0
Silica (SiO_2)	24	9.6	---	11
Total dissolved solids in parts per million	196	77	196	99
Percent sodium	15	8	11	8
Hardness as $CaCO_3$ in parts per million				
Total	146	54	146	78
Noncerbonate	33	0.0	33	2
Turbidity	85	2	58	2
Coliform in most probable number per milliliter (Not Measured)				
Radioectivity in micro-micro curies per liter				
Dissolved alpha	30.0	0.15	---	0.23
Solid elpha	0.46	0.00	0.46	---
Dissolved beta	3.15	1.6	---	1.6
Solid beta	4.6	0.00	4.6	---

WATER QUALITY VARIATIONS



THOMES CREEK NEAR MOUTH (STA. NO. 95b)

STONY CREEK AT BLACK BUTTE DAM SITE (STA. 13c)

Sampling Point. Station 13c is situated within Section 29 of Township 23 North, Range 4 West, Mt. Diablo Base and Meridian. Monthly grab samples of water were collected from the right bank in the vicinity of the USGS gage, 120 feet downstream from the diversion dam, and 8.7 miles northwest of Orland.

Period of Record. January 1958 through December 1961.

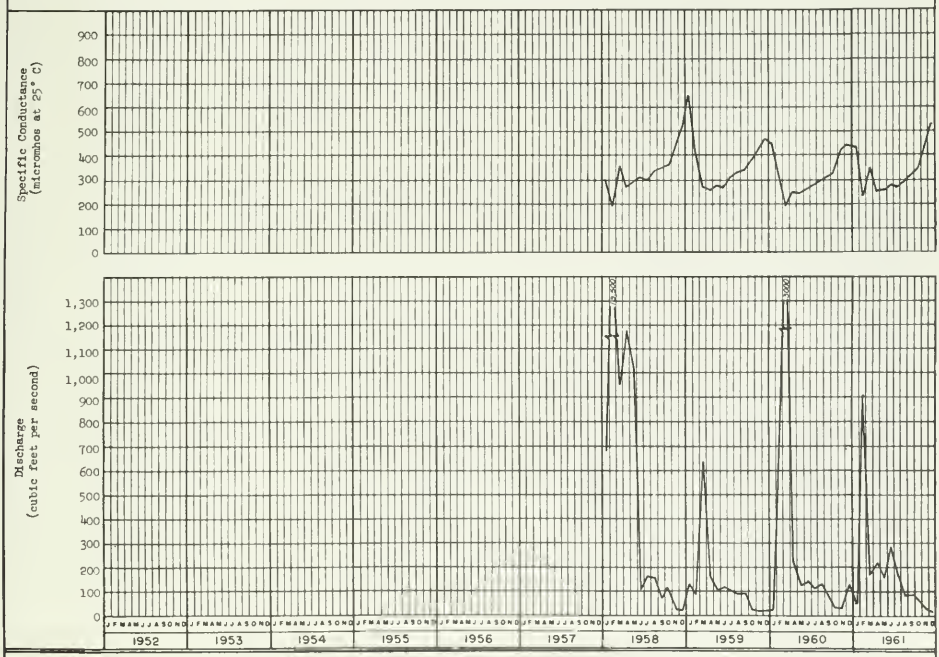
Water Quality Characteristics. Stony Creek at Black Butte Dam Site is generally calcium bicarbonate in character, ranges from slightly hard to moderately hard, meets drinking water standards for mineral content, and is class 1 for irrigation.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	634	194	519	232
Temperature in °F	79	46	79	49
Dissolved oxygen in parts per million	11.3	7.7	11.1	8.0
Percent saturation	112	87	102	91
pH	8.4	7.4	8.4	7.6
Mineral constituents in parts per million				
Calcium (Ca)	55	22	47	26
Magnesium (Mg)	24	6.8	15	6.8
Sodium (Na)	42	7.2	26	12
Potassium (K)	2.3	0.2	0.9	0.2
Carbonate (CO_3)	5	0.0	5	0.0
Bicarbonate (HCO_3)	229	81	206	98
Sulfate (SO_4)	60	9.0	27	10
Chloride (Cl)	85	6.0	54	13
Nitrate (NO_3)	3.5	0.0	0.5	0.0
Fluoride (F)	0.4	0.0	0.2	0.0
Boron (B)	0.5	0.0	0.3	0.0
Silica (SiO_2)	25	8.9	12	8.9
Total dissolved solids in parts per million	371	114	306	134
Percent sodium	28	13	24	20
Hardness as $CaCO_3$ in parts per million				
Total	234	84	210	93
Noncarbonate	89	0.0	55	0.0
Turbidity	150	1	70	1
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.58	0.00	0.16	0.00
Solid alpha	0.56	0.0	0.08	0.0
Dissolved beta	12.3	1.52	12.3	5.0
Solid beta	12.12	0.45	5.9	0.45

WATER QUALITY VARIATIONS



STONY CREEK AT BLACK BUTTE DAM SITE (STA. NO. 13c)

STONY CREEK NEAR HAMILTON CITY (STA. 13a)

Sampling Point. Hamilton City station is located in Section 36 of Township 22 North, Range 2 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, at the USGS gage, 8 miles east of Orland, 2.5 miles southwest of Hamilton City, and 4 miles upstream from the mouth.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Analyses show the water at the station to be calcium-magnesium bicarbonate in character, slightly to moderately hard, within drinking water standards for mineral content, and class 1 irrigation water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	523	157	472	283
Temperature in °F	85	41	71	49
Dissolved oxygen in parts per million	13.1	5.6	12.3	7.9
Percent saturation	125	66	107	89
pH	8.5	7.0	8.4	7.6
Mineral constituents in parts per million				
Calcium (Ca)	42	22	33	---
Magnesium (Mg)	18	6.3	---	12
Sodium (Na)	28	6.6	22	13
Potassium (K)	2.3	0.6	---	0.8
Carbonate (CO_3)	8	0.0	5	0.0
Bicarbonate (HCO_3)	197	84	180	126
Sulfate (SO_4)	22	13	---	14
Chloride (Cl)	64	4	44	16
Nitrate (NO_3)	0.8	0.0	---	0.0
Fluoride (F)	0.2	0.0	0.2	---
Boron (B)	0.64	0.0	0.2	0.0
Silica (SiO_2)	18	10	---	6.2
Total dissolved solids in parts per million	301	90	271	163
Percent sodium	25	14	21	19
Hardness as $CaCO_3$ in parts per million				
Total	194	65	194	119
Noncarbonate	67	0.0	46	10
Turbidity	1,000	0.0	30	2
Coliform in most probable number per milliliter	2,400.	0.046	23.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.48	0.00	0.25	---
Solid alpha	1.18	0.00	---	0.17
Dissolved beta	2.48	0.00	---	0.0
Solid beta	9.62	0.00	5.2	---

WATER QUALITY VARIATIONS

STONY CREEK NEAR HAMILTON CITY (STA. NO. 13a)

CLEAR LAKE AT LAKEPORT (STA. 41)

Sampling Point. Station 41, the only active station on Clear Lake during 1960-61, is located in Section 24 of Township 14 North, Range 10 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the end of the pier at the foot of Third Street at the end of the park in Lakeport, Lake County.

Period of Record. April 1951 through December 1961.

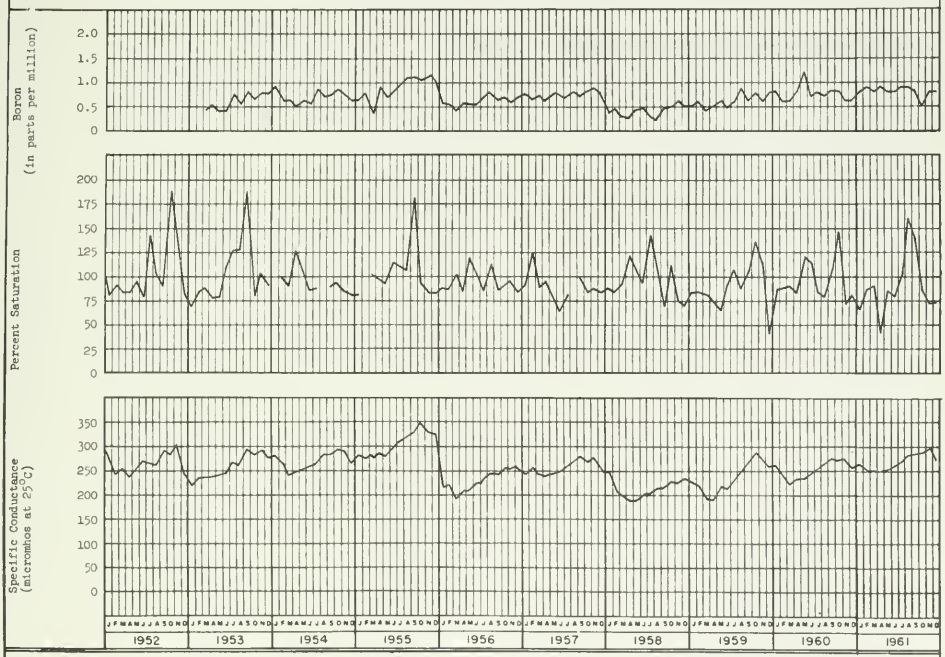
Water Quality Characteristics. Mineral analyses show the water of Clear Lake to be characteristically magnesium-calcium bicarbonate, slightly hard to moderately hard, and within drinking water standards for mineral content. Boron frequently causes the water to be class 2 for irrigation use. Faulting and past volcanic activity are believed to be the cause of the boron in the highly mineralized springs in the Clear Lake area.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	358	187	297	250
Temperature in °F	86	41	81	45
Dissolved oxygen in parts per million	16.0	1.0	13.0	4.5
Percent saturation	192	12	161	42
pH	8.7	6.8	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	30	17	24	22
Magnesium (Mg)	21	10	21	15
Sodium (Na)	17	6.4	13	9.2
Potassium (K)	2.8	1.4	2.4	1.8
Carbonate (CO_3)	11	0	0	0
Bicarbonate (HCO_3)	212	104	176	135
Sulfate (SO_4)	12	5.8	9.6	7.0
Chloride (Cl)	10	3.5	8.8	4.5
Nitrate (NO_3)	11	0.1	3.2	1.7
Fluoride (F)	0.4	0.0	0.1	0.0
Boron (B)	1.23	0.2	0.9	0.5
Silica (SiO_2)	16	0.7	14	10
Total dissolved solids in parts per million	199	105	174	140
Percent sodium	19	13	18	13
Hardness as $CaCO_3$ in parts per million				
Total	158	82	140	110
Noncarbonate	4	0	1	0
Turbidity	140	0.4	120	6
Coliform in most probable number per milliliter	>7,000.	<0.045	62.	<0.045
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.24	0.00	0.24	0.0
Solid alpha	0.59	0.00	0.24	0.0
Dissolved beta	12.60	0.00	8.5	3.5
Solid beta	10.80	0.00	5.6	4.5

WATER QUALITY VARIATIONS



CLEAR LAKE AT LAKEPORT (STA. NO. 41)

CACHE CREEK NEAR LOWER LAKE (STA. 42)

Sampling Point. Station 42, which monitors outflow from Clear Lake to Cache Creek, is situated in Section 6 of Township 12 North, Range 6 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank at the USGS gaging station, approximately 500 feet downstream from Cache Creek Dam, 3.5 miles east of State Highway 53, and 5 miles southeast of Lower Lake, Lake County.

Period of Record. April 1951 through December 1961.

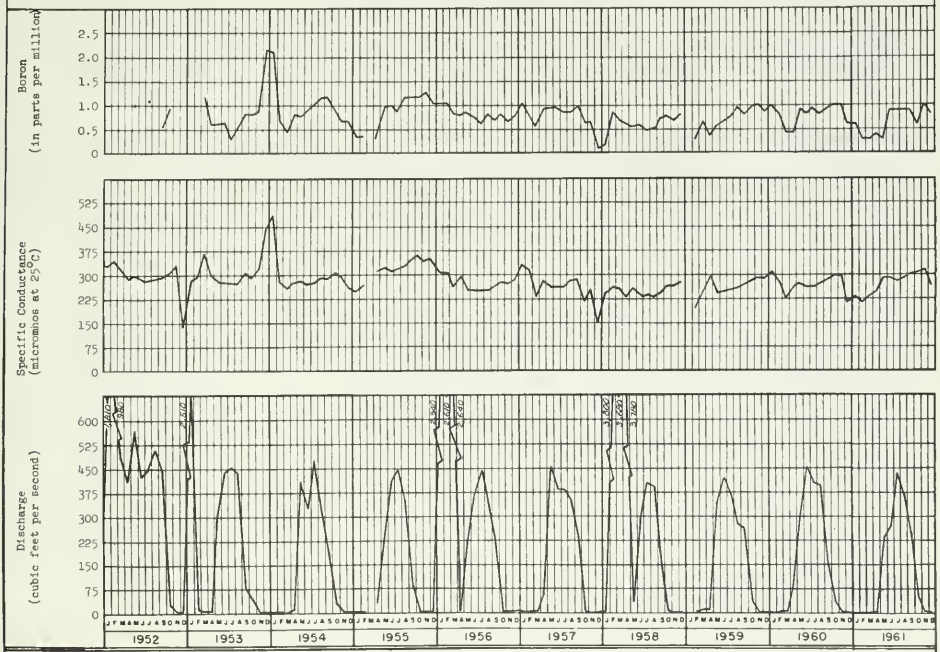
Water Quality Characteristics. Analyses show Cache Creek water at Station 42 to be similar to the water in Clear Lake at Lakeport (Station 41), magnesium-calcium bicarbonate in character, usually moderately hard, and meets drinking water standards for mineral content. Boron generally causes the water to be class 2 for irrigation use during a major portion of the year.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	490	137	314	214
Temperature in °F	84	39	80	40
Dissolved oxygen in parts per million	13.2	4.2	11.0	7.2
Percent saturation	135	42	99	84
pH	8.7	6.8	8.2	7.4
Mineral constituents in parts per million				
Calcium (Ca)	34	16	26	25
Magnesium (Mg)	31	11	19	16
Sodium (Na)	25	7.6	14	9.2
Potassium (K)	1.9	1.7	2.7	2.3
Carbonate (CO_3)	3	0	3	0
Bicarbonate (HCO_3)	241	46	181	98
Sulfate (SO_4)	13	5.8	9.0	8.0
Chloride (Cl)	36	3.0	9.2	3.8
Nitrate (NO_3)	5.4	0.0	1.9	0.9
Fluoride (F)	0.5	0.0	0.1	0.0
Boron (B)	2.2	0.08	1.0	0.3
Silica (SiO_2)	13	0.06	7.0	0.6
Total dissolved solids in parts per million	272	76	174	120
Percent sodium	23	14	20	14
Hardness as $CaCO_3$ in parts per million				
Total	200	56	140	87
Noncarbonate	17	0	17	0
Turbidity	340	0.9	50	4
Coliform in most probable number per milliliter	>7,000.	<0.045	620.	0.5
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.89	0.00	0.31	0.0
Solid alpha	0.51	0.00	0.17	0.0
Dissolved beta	23.8	0.00	4.8	0.2
Solid beta	12.7	0.00	12.7	0.4

WATER QUALITY VARIATIONS



CACHE CREEK NEAR LOWER LAKE (STA. NO. 42)

CACHE CREEK NEAR CAPAY (STA. 80)

Sampling Point. The Capay Station is located in Section 8, Township 10 North, Range 2 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the USGS gaging station, 2 miles upstream from the Clear Lake Water Company Diversion Dam, and 3 miles northwest of Capay, Yolo County.

Period of Record. December 1951 through December 1961.

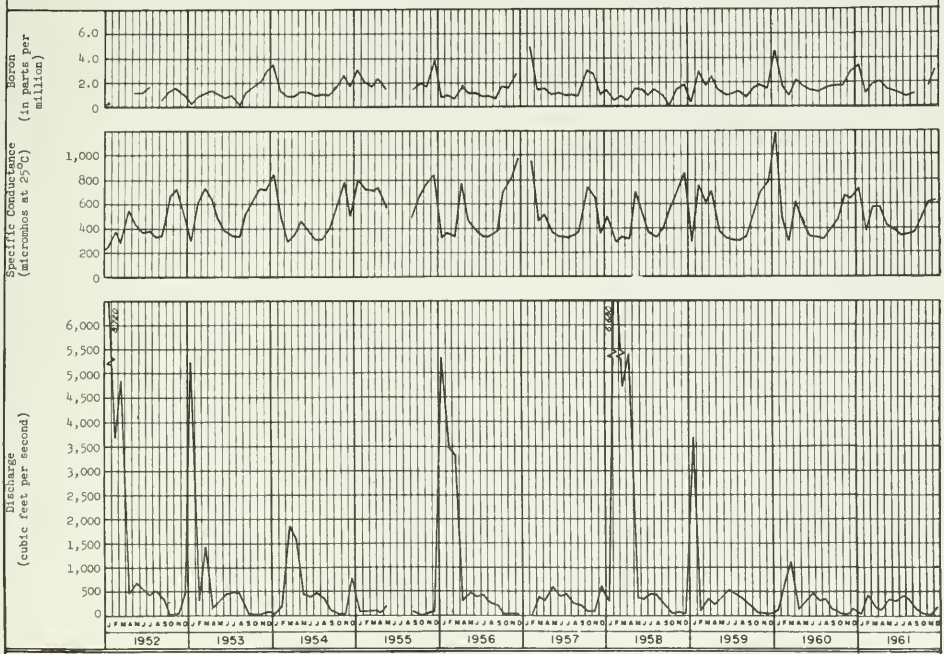
Water Quality Characteristics. Cache Creek water at Station 80, as at upstream stations, is magnesium-calcium bicarbonate in character, moderately to very hard, within mineral standards for drinking water, and varies from class 1 to 3 for irrigation use. Boron usually causes the water to be class 2 or class 3 for irrigation use during the major part of the year. The stream becomes class 1 following heavy precipitation when increased flow provides sufficient dilution. The effects of North Fork tributary flow have perenially been reflected by significant increases in most constituents in Cache Creek between Lower Lake and Capay.

Significant Water Quality Changes. Maximum values of record for specific conductance, total dissolved solids, chloride, and hardness were recorded during 1960.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,140	210	722	324
Temperature in °F	88	41	82	44
Dissolved oxygen in parts per million	12.5	7.7	12.2	7.8
Percent saturation	121	87	104	88
pH	8.4	6.8	8.3	7.6
Mineral constituents in parts per million				
Calcium (Ca)	50	11	28	26
Magnesium (Mg)	58	15	23	22
Sodium (Na)	106	11	61	17
Potassium (K)	3.6	0.2	3.3	2.8
Carbonate (CO_3)	11	0	11	0
Bicarbonate (HCO_3)	343	96	237	163
Sulfate (SO_4)	56	5.0	17	11
Chloride (Cl)	200	9.0	88	12
Nitrate (NO_3)	2.4	0.0	0.3	0.2
Fluoride (F)	0.3	0.0	0.3	0.2
Boron (B)	5.0	0.15	3.4	0.9
Silica (SiO_2)	20	3.4	13	6.5
Total dissolved solids in parts per million	633	117	402	180
Percent sodium	42	16	37	21
Hardness as $CaCO_3$ in parts per million				
Total	355	83	239	140
Noncarbonate	266	0	27	0
Turbidity	1,800	0	35	1
Coliform in most probable number per milliliter	2,400.	0.023	230.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.81	0.00	0.27	0.26
Solid alpha	0.69	0.00	0.44	0.0
Dissolved beta	7.58	0.00	6.4	2.6
Solid beta	13.2	0.00	13.2	9.0

WATER QUALITY VARIATIONS



CACHE CREEK NEAR CAPAY (STA. NO. 80)

CACHE CREEK, NORTH FORK NEAR LOWER LAKE (STA. 79)

Sampling Point. Station 79 is located in Section 31, Township 14 North, Range 6 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the USGS gaging station, 2.7 miles upstream from Highway 20 bridge, 6 miles east of Clear Lake Oaks, and 10 miles north of Lower Lake, Lake County.

Period of Record. December 1951 through December 1961.

Water Quality Characteristics. Past analyses show the principal cations to be calcium and magnesium, and the principal anion to be bicarbonate. Water at this station consistently meets drinking water requirements for mineral content, and is in the slightly to very hard range. Boron concentrations generally cause the water to be class 3 for irrigation use during the major portion of the year. Only during extremely wet seasons is boron found in concentrations less than the 0.5 ppm limit for class 1 irrigation water.

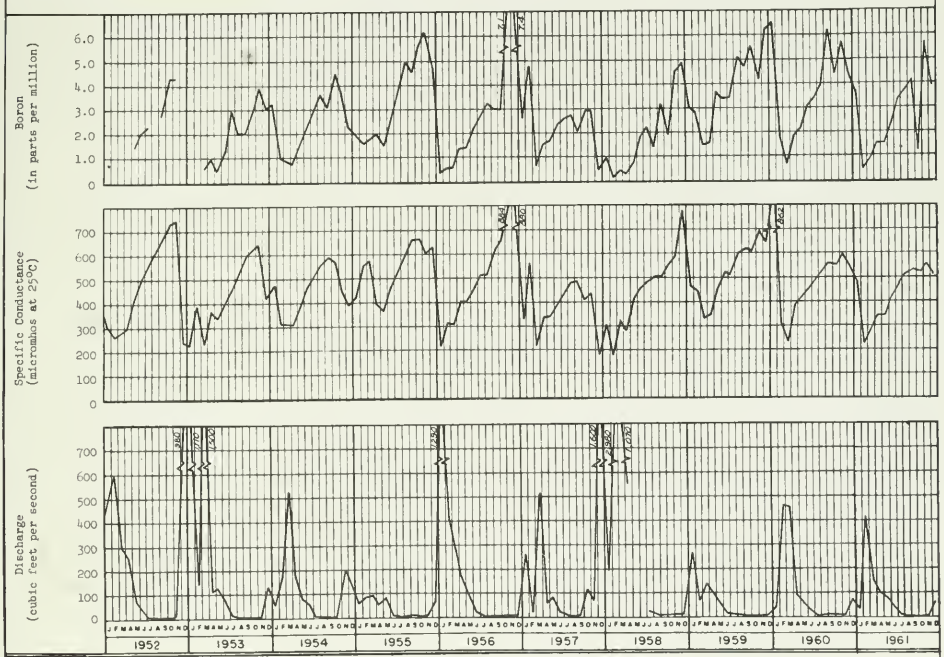
Faulting and past volcanic activity are believed to be the cause of boron in the highly mineralized springs in this area.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	884	181	556	223
Temperature in °F	90	38	86	38
Dissolved oxygen in parts per million	14.4	5.0	13.3	8.7
Percent saturation	139	57	121	95
pH	8.5	6.8	8.4	7.6
Mineral constituents in parts per million				
Calcium (Ca)	50	16	32	25
Magnesium (Mg)	53	11	27	20
Sodium (Na)	87	7.2	44	9.8
Potassium (K)	2.5	0.7	1.6	0.7
Carbonate (CO_3)	19	0	14	0
Bicarbonate (HCO_3)	287	98	207	117
Sulfate (SO_4)	21	0.0	16	11
Chloride (Cl)	45	4.0	60	5.5
Nitrate (NO_3)	1.6	0.0	0.6	0.3
Fluoride (F)	0.1	0.0	0.1	0.1
Boron (B)	7.4	0.16	5.7	0.5
Silice (SiO_2)	24	13	19	19
Total dissolved solids in parts per million	500	102	315	127
Percent sodium	49	14	34	18
Hardness as $CaCO_3$ in parts per million				
Total	344	76	192	96
Noncarbonate	111	0	22	0
Turbidity	600	0	100	1
Coliform in most probable number per milliliter	2,400.	0.02	230.	0.2
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.85	0.00	0.41	0.0
Solid alpha	0.73	0.00	0.25	0.0
Dissolved beta	12.64	0.00	6.8	1.0
Solid beta	12.06	0.00	8.6	2.2

WATER QUALITY VARIATIONS



CACHE CREEK, NORTH FORK NEAR LOWER LAKE (STA. NO. 79)

PUTAH CREEK NEAR WINTERS (STA. 81)

Sampling Point. Station 81 is located in Section 27 of Township 8 North, Range 2 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank, 1 mile downstream from the USGS gaging station, and 8.2 miles west of Winters, Yolo County.

Period of Record. December 1951 through December 1961.

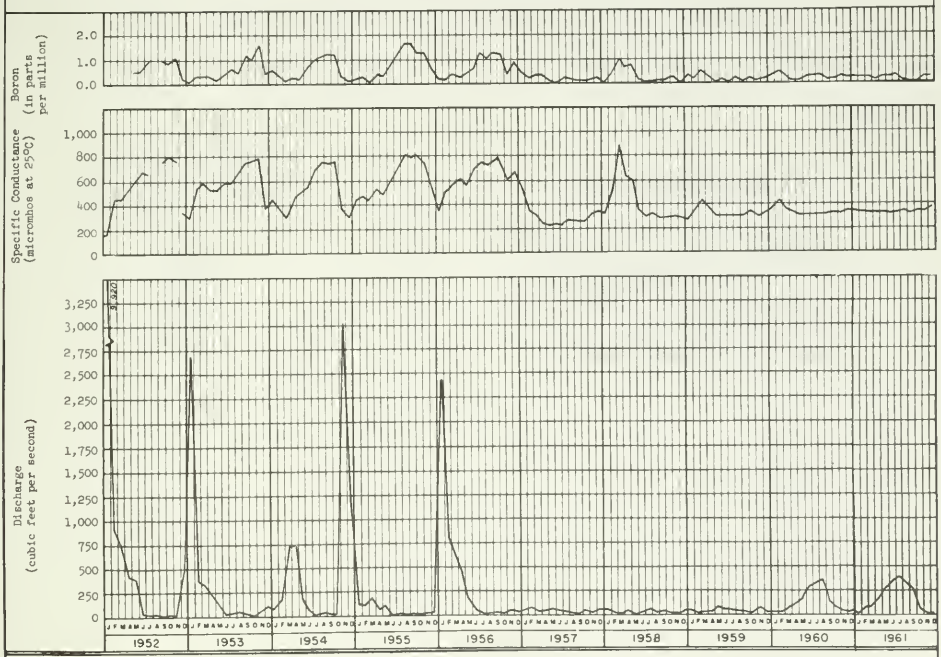
Water Quality Characteristics. Past analyses collected at Station 81 indicate the water to be magnesium bicarbonate in character, moderately hard, and meets drinking water requirements for mineral content.

Significant Water Quality Changes. Boron in the past has caused the water to be class 2, intermittently, for irrigation use, with the exception of the past three years (1959-61) when the waters have been class 1. The lower, more uniform boron content during this period may be due to dilution and mixing in Lake Berryessa, or to below normal rainfall, resulting in less subsurface inflow to Putah Creek above Lake Berryessa.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	668	116	365	316
Temperature in °F	84	43	66	43
Dissolved oxygen in parts per million	14.8	2.0	13.6	9.8
Percent saturation	142	22	130	91
pH	8.4	6.8	8.3	7.4
Mineral constituents in parts per million				
Calcium (Ca)	113	13	20	20
Magnesium (Mg)	70	13	26	26
Sodium (Na)	70	2.5	12	7.7
Potassium (K)	5.6	0.2	1.8	1.8
Carbonate (CO_3)	35	0	20	0
Bicarbonate (HCO_3)	448	73	195	144
Sulfate (SO_4)	79	8.6	15	11
Chloride (Cl)	50	2.0	12	4.2
Nitrate (NO_3)	2.7	0.0	0.4	0.3
Fluoride (F)	0.4	0.0	0.2	0.2
Boron (B)	1.7	0.00	0.3	0.0
Silica (SiO_2)	29	13	15	13
Total dissolved solids in parts per million	520	88	220	175
Percent sodium	28	6	13	9
Hardness as $CaCO_3$ in parts per million				
Total	371	67	148	156
Noncarbonate	55	0	11	1
Turbidity	1,000	0	10	1
Coliform in most probable number per milliliter	>7,000.	0.023	62.	0.046
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.43	0.00	0.35	
Solid alpha	1.02	0.00	0.17	
Dissolved beta	2.0	0.00	1.0	
Solid beta	3.80	0.00	0.0	

WATER QUALITY VARIATIONS



PUTAH CREEK NEAR WINTERS (STA. NO. 81)

Sacramento Valley Northeast Stream Unit

Several small stream basins which drain the 1,140 square miles east of the northeastern portion of Sacramento Valley are included in this unit. These streams originate in the Sierra Nevada and flow along steep parallel courses to the valley floor. They have only minor tributaries and little development along their route. Principal streams in the unit, from north to south, are Antelope, Mill, Deer, Big Chico, and Butte Creeks. Annual natural mean runoff is about 1,800,000 acre-feet.

The terrain of these basins is almost entirely mountainous with only a few headwater valleys adaptable to irrigated agriculture. Agricultural, livestock raising, mining, recreational, and lumbering activities are carried on in these basins.

There are no significant waste discharges entering streams in this unit.

The following tabulation presents the names of stations maintained to monitor quality of surface water in this unit, and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Antelope Creek near Red Bluff	224
Antelope Creek near mouth	226
Mill Creek near Los Molinos	228
Big Chico Creek near Chico	230
Big Chico Creek at Chico	232
Butte Creek near Chico	234

ANTELOPE CREEK NEAR RED BLUFF (STA. 88e)

Sampling Point. Red Bluff station is located in Section 8 of Township 27 North, Range 2 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the center of flow at the USGS stream gaging station, approximately 4 miles east of Highway 99E on Belle Mill Road, and 9.5 miles east of Red Bluff. This sampling point is 0.9 mile upstream from the previous site.

Period of Record. October 1958 through December 1961.

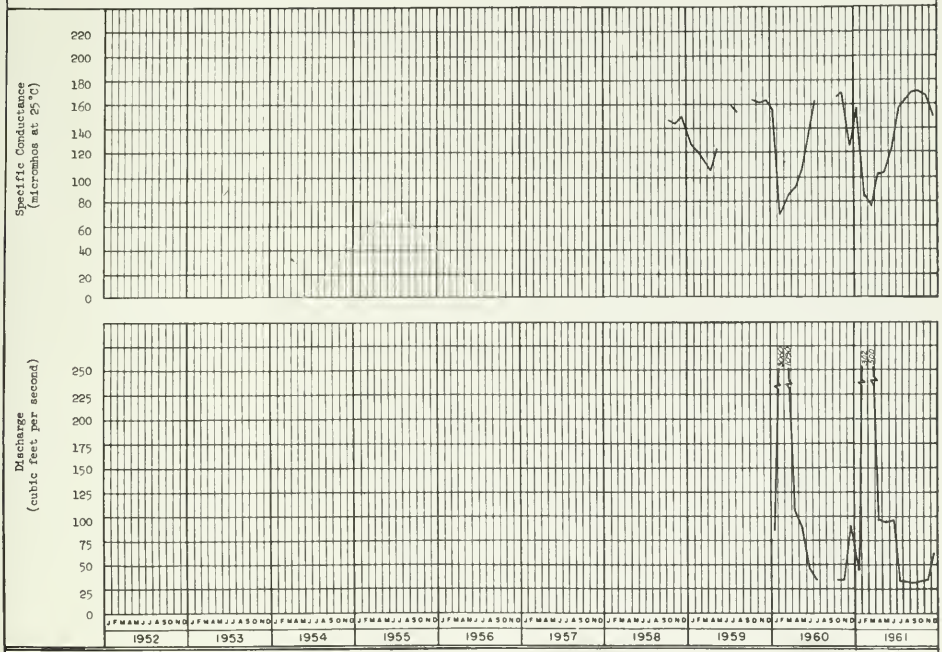
Water Quality Characteristics. Antelope Creek water at the Red Bluff station is bicarbonate in type with no predominant cation, soft to slightly hard, class 1 for irrigation, and suitable for industrial and domestic uses.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	170	69.0	170	75
Temperature in °F	82	37	82	37
Dissolved oxygen in parts per million	13.5	7.5	13.5	8.1
Percent saturation	108	88	108	88
pH	8.4	7.1	8.4	7.4
Mineral constituents in parts per million				
Calcium (Ca)	14	6.8	13	9.2
Magnesium (Mg)	9.5	4.1	6.7	4.1
Sodium (Na)	15	2.5	13	3.1
Potassium (K)	3.1	0.8	1.4	1.0
Carbonate (CO_3)	4	0.0	2	0.0
Bicarbonate (HCO_3)	90	20	90	45
Sulfate (SO_4)	15	0.0	0.0	0.0
Chloride (Cl)	12	2.0	11	0.8
Nitrate (NO_3)	2.1	0.0	0.2	0.0
Fluoride (F)	0.1	0.0	0.1	0.1
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	41	29	41	29
Total dissolved solids in parts per million	145	55	137	60
Percent sodium	36	16	33	16
Hardness as $CaCO_3$ in parts per million				
Total	65	28	61	33
Noncarbonate	12	0.0	0.0	0.0
Turbidity	50	1	19	1
Coliform in most probable number per milliliter (Not Measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.31	0.0	0.31	0.0
Solid alpha	0.55	0.00	0.0	0.00
Dissolved beta	9.49	0.0	1.8	0.0
Solid beta	3.49	0.00	0.2	0.0

WATER QUALITY VARIATIONS



ANTELOPE CREEK NEAR RED BLUFF (STA. NO. 88e)

ANTELOPE CREEK NEAR MOUTH (STA. 88c)

Sampling Point. Station 88c is located in Section 17 of Township 26 North, Range 2 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected at State Highway 99E bridge, approximately 1.5 miles above the mouth, and about 9 miles southeast of the town of Red Bluff.

Period of Record. October 1958 through December 1961.

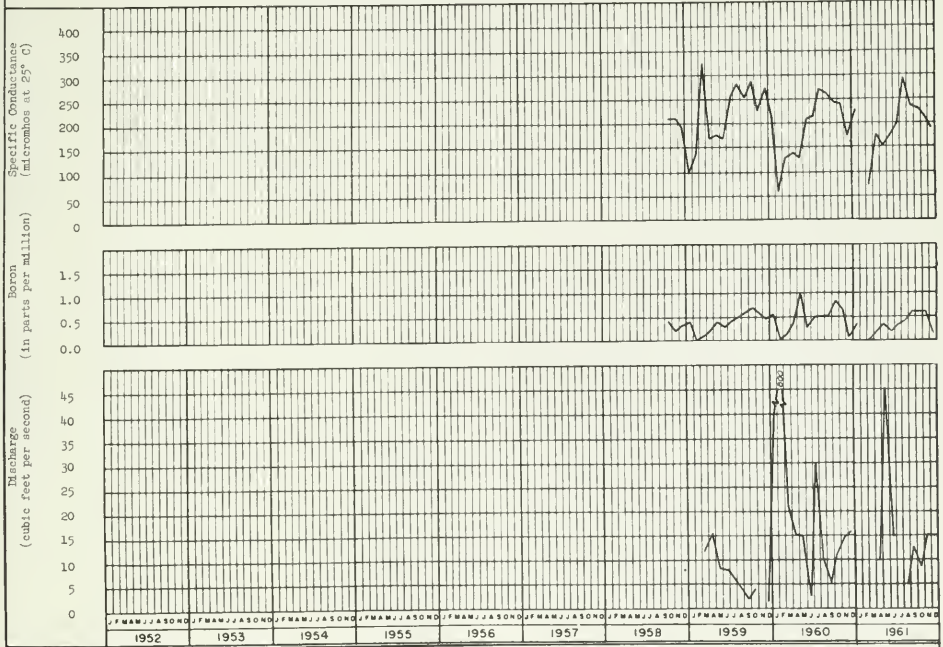
Water Quality Characteristics. Analyses showed the water to be bicarbonate in type with no predominant cation, soft to slightly hard, and occasionally class 2 for irrigation due to boron concentrations.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	327	64.4	289	75
Temperature in °F	82	41	82	41
Dissolved oxygen in parts per million	12.0	6.3	12.0	6.3
Percent saturation	119	64	119	64
pH	8.1	7.0	8.1	7.1
Mineral constituents in parts per million				
Calcium (Ca)	25	7.6	16	11
Magnesium (Mg)	20	3.5	9.0	3.5
Sodium (Na)	24	2.2	20	3.1
Potassium (K)	6.7	0.7	4.0	3.7
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	160	22	133	44
Sulfate (SO_4)	31	3.8	14	13
Chloride (Cl)	32	0.5	21	0.5
Nitrate (NO_3)	6.7	0.0	0.8	0.0
Fluoride (F)	0.2	0.0	0.2	0.1
Boron (B)	1.0	0.0	0.6	0.0
Silica (SiO_2)	54	25	43	31
Total dissolved solids in parts per million	217	47	212	55
Percent sodium	40	15	39	16
Hardness as $CaCO_3$ in parts per million				
Total	143	26	110	33
Noncarbonate	15	0.0	7	0.0
Turbidity	400	2	35	2
Coliform in most probeble number per milliliter (Not measured)				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.91	0.00	0.16	0.0
Solid alpha	0.53	0.09	0.08	0.0
Dissolved beta	6.2	0.31	4.7	0.5
Solid beta	0.21	0.00	0.0	0.0

WATER QUALITY VARIATIONS



ANTELOPE CREEK NEAR MOUTH (STA. NO. 88c)

MILL CREEK NEAR MOUTH (STA. 88)

Sampling Point. Station 88 is located in Section 9 of Township 25 North, Range 2 West, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, below State Highway 99E bridge, about 1.5 miles north of Los Molinos.

Period of Record. July 1952 through December 1961.

Water Quality Characteristics. Water at this station is bicarbonate in type with no predominant cation, drinking water requirements for mineral content are met, hardness ranges from soft to slightly hard, and the water is good for most industrial uses. Boron periodically placed this water in class 2 for irrigation.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	261	70	261	112
Temperature in °F	93	37	85	42
Dissolved oxygen in parts per million	13.5	7.0	13.1	7.9
Percent saturation	140	84	139	85
pH	8.3	6.7	8.1	7.1
Mineral constituents in parts per million				
Calcium (Ca)	22	6.2	22	9.6
Magnesium (Mg)	13	1.1	8.5	3.4
Sodium (Na)	21	4.1	20	7.1
Potassium (K)	3.8	1.0	3.2	1.6
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	98	25	98	32
Sulfate (SO_4)	25	7.7	18	13
Chloride (Cl)	28	2.5	25	7.2
Nitrate (NO_3)	0.7	0.0	0.2	0.0
Fluoride (F)	0.2	0.0	0.2	0.1
Boron (B)	0.8	0.0	0.7	0.0
Silica (SiO_2)	44	26	37	29
Total dissolved solids in parts per million	192	52	181	83
Percent sodium	43	22	43	28
Hardness as $CaCO_3$ in parts per million				
Total	99	22	90	33
Noncerbonate	22	0.0	12	0.0
Turbidity	200	0.0	15	1
Coliform in most probable number per milliliter	2,400.	0.045-	620.	0.045
Radioactivity in micro-micro curies per liter (not measured)				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid beta				

WATER QUALITY VARIATIONS

MILL CREEK NEAR MOUTH (STA. NO. 88)

BIG CHICO CREEK NEAR CHICO (STA. 85)

Sampling Point. Station 85 is located in Section 9 of Township 22 North, Range 2 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the USGS gage, approximately 6 miles northeast of Chico, and 12.9 miles upstream from the mouth.

Period of Record. July 1952 through December 1961.

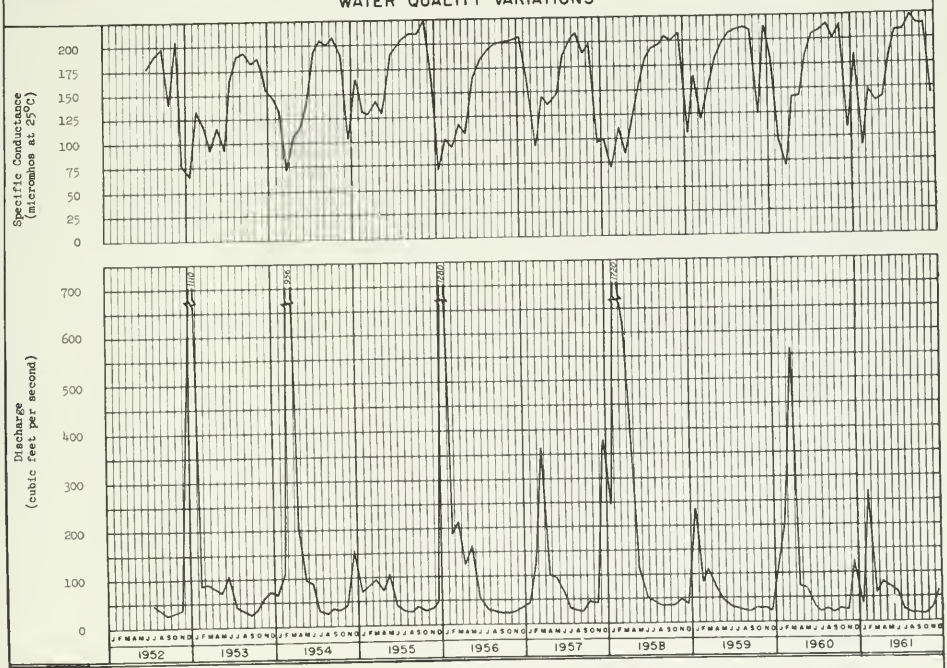
Water Quality Characteristics. Past records show the water to be consistently good to excellent in quality, calcium-magnesium or magnesium-calcium bicarbonate in type, class 1 for irrigation, soft to slightly hard, and suitable for almost all domestic and industrial purposes.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	223	65	223	91.3
Temperature in °F	78	36	78	38
Dissolved oxygen in parts per million	13.4	7.6	13.2	8.0
Percent saturation	113	83	102	88
pH	8.5	6.8	8.5	7.3
Mineral constituents in parts per million				
Calcium (Ca)	20	4.0	17	10
Magnesium (Mg)	9.8	2.8	8.6	6.6
Sodium (Na)	18	2.2	17	3.3
Potassium (K)	2.3	0.4	2.2	1.1
Carbonate (CO_3)	3	0.0	2	0.0
Bicerbonate (HCO_3)	118	37	113	49
Sulfate (SO_4)	6.3	0.0	3.2	3.0
Chloride (Cl)	18	0.4	14	2.0
Nitrate (NO_3)	3.9	0.0	3.9	0.4
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.3	0.0	0.3	0.0
Silica (SiO_2)	42	30	39	33
Total dissolved solids in parts per million	162	47	160	67
Percent sodium	34	13	32	16
Hardness as $CaCO_3$ in parts per million				
Total	92	27	78	38
Noncarbonate	31	0.0	31	0.0
Turbidity	125	0.0	13	1
Coliform in most probable number per milliliter	7,000.	0.06	2,400.	0.06
Radioactivity in micro-micro curies per liter (not measured)				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid beta				

WATER QUALITY VARIATIONS



BIG CHICO CREEK NEAR CHICO (STA. NO. 85)

BIG CHICO CREEK AT CHICO (STA. 85a)

Sampling Point. Station 85a is located in Section 28 of Township 22 North, Range 1 East, Mt. Diablo Base and Meridian. Monthly water samples were collected 25 feet upstream from the Rose Avenue bridge, at the intersection of Rose and Bidwell Avenues, in the City of Chico.

Period of Record. January 1959 through December 1961.

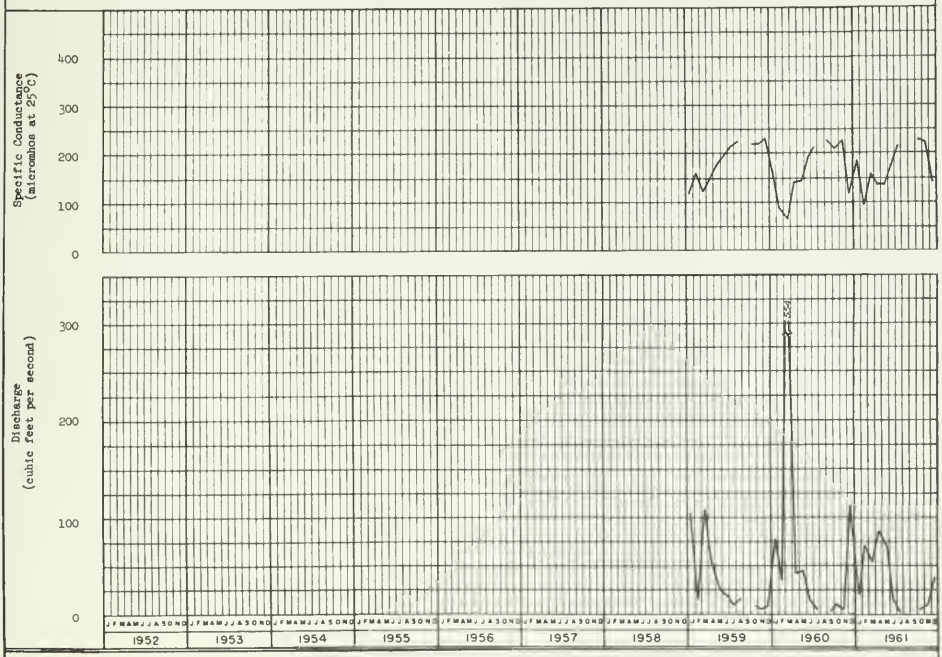
Water Quality Characteristics. The water at Station 85a is excellent in quality, generally calcium-magnesium bicarbonate, class 1 for irrigation, soft to slightly hard, and has a mineral content which meets drinking water requirements.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	225	66.3	225	98.9
Temperature in °F	78	39	74	39
Dissolved oxygen in parts per million	13.6	6.2	13.6	8.0
Percent saturation	114	69	114	69
pH	8.4	7.1	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	20	8.8	11	---
Magnesium (Mg)	8.9	4.4	---	6.0
Sodium (Na)	18	2.6	16	4.1
Potassium (K)	2.5	0.6	---	0.5
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	120	32	117	49
Sulfate (SO_4)	18	0.0	---	3.0
Chloride (Cl)	16	2.5	13	2.8
Nitrate (NO_3)	1.0	0.0	0.4	---
Fluoride (F)	0.4	0.0	---	0.1
Boron (B)	0.3	0.0	0.3	0.0
Silica (SiO_2)	47	27	---	34
Total dissolved solids in parts per million	169	50	169	74
Percent sodium	34	17	31	18
Hardness as $CaCO_3$ in parts per million				
Total	81	27	78	40
Noncarbonate	6	0.0	0	0.0
Turbidity	50	1	13	1
Coliform in most probable number per milliliter	(Not measured)			
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.48	0.15	0.48	---
Solid alpha	0.60	0.08	---	0.24
Dissolved beta	2.22	0.00	---	0.0
Solid beta	6.4	0.00	6.4	---

WATER QUALITY VARIATIONS



BIG CHICO CREEK AT CHICO (STA. NO. 85a)

BUTTE CREEK NEAR CHICO (STA. 84)

Sampling Point. Station 84 is located in Section 36 of Township 22 North, Range 2 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the USGS gage, 0.8 mile downstream from Little Butte Creek, and 7.5 miles east of Chico.

Period of Record. July 1952 through December 1961.

Water Quality Characteristics. The character of the water at Station 84 is generally calcium-magnesium bicarbonate, soft, class 1 for irrigation, meets drinking water standards, and is excellent for industrial uses.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	127	47	126	73
Temperature in °F	75	35	75	37
Dissolved oxygen in parts per million	13.8	7.5	13.2	8.7
Percent saturation	114	70	103	87
pH	8.3	6.8	8.2	7.2
Mineral constituents in parts per million				
Calcium (Ca)	16	4.8	12	6.4
Magnesium (Mg)	6.6	1.2	4.9	3.2
Sodium (Na)	6.4	1.2	4.9	2.2
Potassium (K)	1.6	0.3	1.1	0.6
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	77	32	77	41
Sulfate (SO_4)	6.0	0.0	0.0	0.0
Chloride (Cl)	5.0	0.0	2.2	0.0
Nitrate (NO_3)	0.5	0.0	0.0	0.0
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.21	0.0	0.1	0.0
Silica (SiO_2)	26	17	22	21
Total dissolved solids in parts per million	94	35	93	56
Percent sodium	23	9.8	19	10
Hardness as $CaCO_3$ in parts per million				
Total	58	21	56	29
Noncarbonate	12	0.0	1	0.0
Turbidity	170	0.0	10	1
Coliform in most probable number per milliliter	620.	0.06	230.	0.21
Radioactivity in micro-micro curies per liter (not measured)				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid beta				

WATER QUALITY VARIATIONS

BUTTE CREEK NEAR CHICO (STA. NO. 84)

Feather River Basin

Feather River drainage is composed of numerous tributaries and is comprised of 3,611 square miles in the northeastern portion of the Central Valley Region. The headwaters of the Feather River, the major tributary to the Sacramento River, originate high in the Sierra Nevada Mountains. Topography of the area is predominantly mountainous with only 687 square miles classified as valley and mesa lands. The average annual runoff of the Feather River Basin is estimated to be 4,596,000 acre-feet.

Lumbering, recreation, and livestock raising are the main economic pursuits in the upper reaches of this basin. In the foothill and valley area, agriculture is the predominant enterprise.

Log ponds, small resort areas, and communities located along the waterway all discharge waste into the river system. The waste discharges of significant quantity are from Gridley (intermittent), Yuba City, and Marysville. Waste discharge effluent has not created significant impairment problems in this basin.

The following tabulation presents the name of stations maintained to monitor quality of surface water in this basin, and the page on which each is discussed:

Monitoring Station	Page Number of Station Discussion
Feather River at Nicolaus	238
Feather River near Oroville	240
Feather River below Shanghai Bend	242
Indian Creek near Crescent Mills	244

FEATHER RIVER AT NICOLAUS (STA. 20)

Sampling Point. Station 20 is located in Section 12 of Township 12 North, Range 3 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank, at the USGS gaging station on Garden Highway bridge at Nicolaus, and 2.9 miles downstream from the confluence with Bear River, in Sutter County.

Period of Record. April 1951 through December 1961.

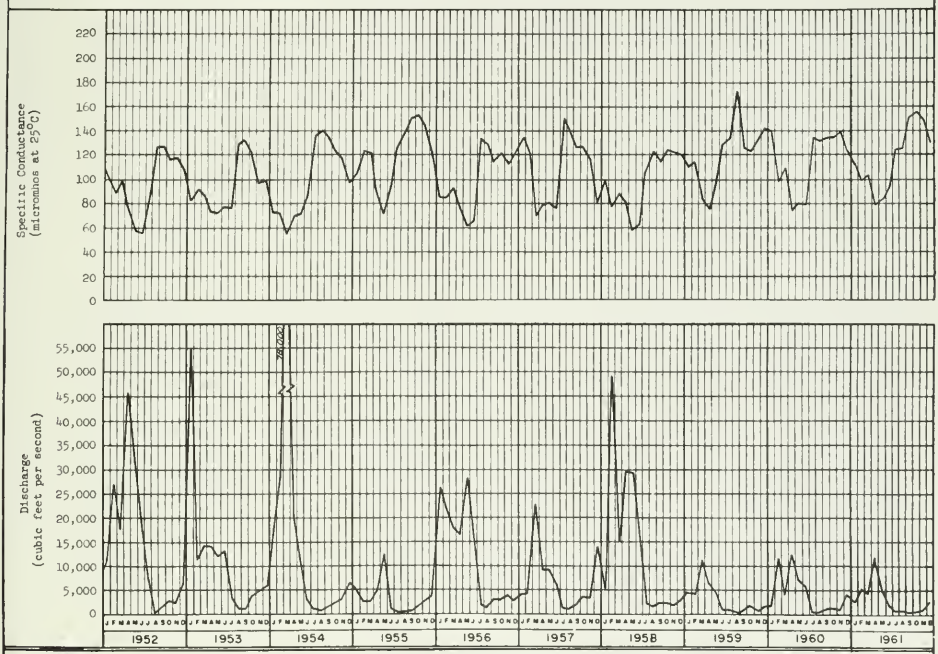
Water Quality Characteristics. Past analyses from Station 20 show the water to be calcium-magnesium bicarbonate in character, class 1 for irrigation, soft to slightly hard, and within drinking water standards for mineral content. There is no significant change in water quality between upstream stations and the Nicolaus station, indicating tributary inflow of such streams as the Yuba and Bear Rivers has little effect on quality of Feather River water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	189	59	162	79
Temperature in °F	85	37	80	41
Dissolved oxygen in parts per million	13.5	7.0	12.0	7.4
Percent saturation	115	72	107	85
pH	7.9	6.5	7.6	7.1
Mineral constituents in parts per million				
Calcium (Ca)	24	5.3	15	8.4
Magnesium (Mg)	8.3	0.4	7.5	2.8
Sodium (Na)	8.6	1.2	8.6	1.2
Potassium (K)	2.2	0.4	1.4	0.7
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	92	30	86	38
Sulfate (SO_4)	8.0	0.0	4.4	4.0
Chloride (Cl)	8.0	0.0	4.0	0.7
Nitrate (NO_3)	1.6	0.0	0.0	0.0
Fluoride (F)	0.1	0.0	0.1	0.0
Boron (B)	0.18	0.00	0.1	0.0
Silica (SiO_2)	21	11	15	13
Total dissolved solids in parts per million	120	36	103	52
Percent sodium	23	6	22	6
Hardness as $CaCO_3$ in parts per million				
Total	75	20	68	35
Noncarbonate	7	0	7	0
Turbidity	120	0	35	2
Coliform in most probable number per milliliter	>7000.	0.06	7,000.	0.45
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.82	0.00	0.31	0.0
Solid alpha	1.22	0.00	0.46	0.0
Dissolved beta	11.92	0.00	4.0	1.6
Solid beta	9.38	0.00	4.5	1.20

WATER QUALITY VARIATIONS



FEATHER RIVER AT NICOLAUS (STA. NO. 20)

FEATHER RIVER NEAR OROVILLE (STA. 19)

Sampling Point. Station 19 is located in Section 2 of Township 19 North, Range 4 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank at the USGS gaging station, 75 feet upstream from State Highway 24 bridge, 2.0 miles downstream from the confluence of the North and Middle Forks of the Feather River, and 4.0 miles northeast of Oroville, Butte County.

Period of Record. April 1951 through December 1961.

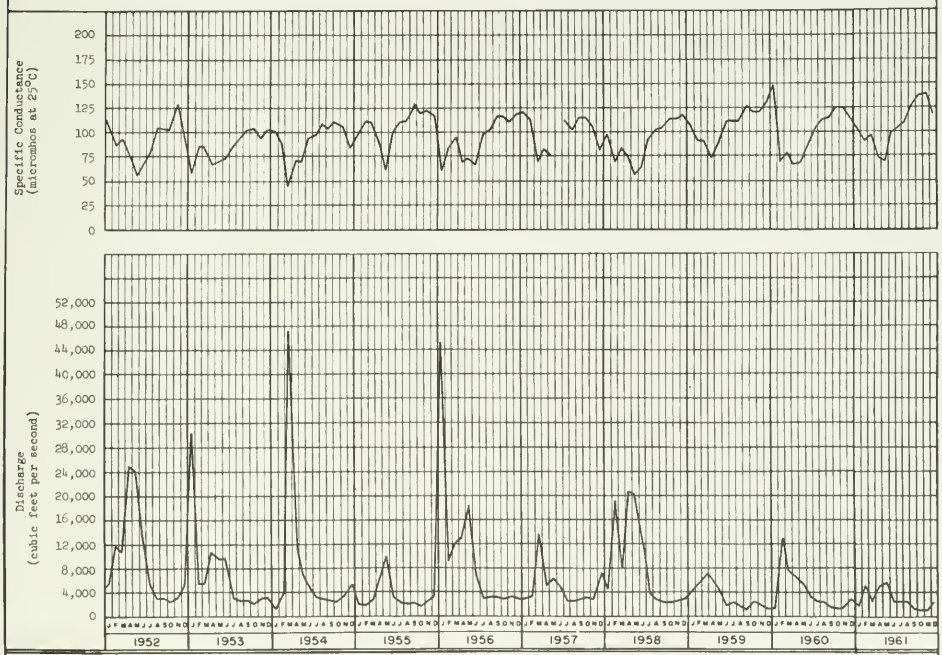
Water Quality Characteristics. Past analyses show the water to be generally calcium-magnesium bicarbonate in character, class 1 for irrigation, usually soft, and within mineral requirements for drinking water. Past analyses reveal this water to be consistently of excellent quality.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	149	48	140	69
Temperature in °F	74	35	73	39
Dissolved oxygen in parts per million	14.5	4.4	13.5	8.1
Percent saturation	120	48	103	84
pH	8.3	6.8	7.6	7.2
Mineral constituents in parts per million				
Calcium (Ca)	16	4.8	12	6.0
Magnesium (Mg)	6.2	1.5	5.6	3.4
Sodium (Na)	7.3	0.9	6.0	2.7
Potassium (K)	3.8	0.3	1.4	0.6
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	80	18	80	39
Sulfate (SO_4)	5.2	0.2	3.0	2 0
Chloride (Cl)	7.0	0.0	3.5	0.5
Nitrate (NO_3)	2.0	0.0	0.2	0.1
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.30	0.00	0.1	0.0
Silica (SiO_2)	21	9.0	19	12
Total dissolved solids in parts per million	105	34	99	51
Percent sodium	25	9	20	16
Hardness as $CaCO_3$ in parts per million				
Total	68	22	59	29
Noncarbonate	16	0	0	0
Turbidity	100	0	10	2
Coliform in most probable number per milliliter	7,000.	0.045	2,400.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.60	0.00	0.31	0.24
Solid alpha	0.34	0.00	0.16	0.12
Dissolved beta	10.81	0.00	4.7	0.5
Solid beta	10.41	0.00	5.5	0.5

WATER QUALITY VARIATIONS



FEATHER RIVER NEAR OROVILLE (STA. NO. 19)

FEATHER RIVER BELOW SHANGHAI BEND (STA. 20a)

Sampling Point. Station 20a is located in Section 11 of Township 14 North, Range 3 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank at the DWR gaging station, 1.2 miles east of the junction of Highway 40 Alternate and Barry Road, and 4.5 miles south of Yuba City, Sutter County.

Period of Record. July 1958 through December 1961.

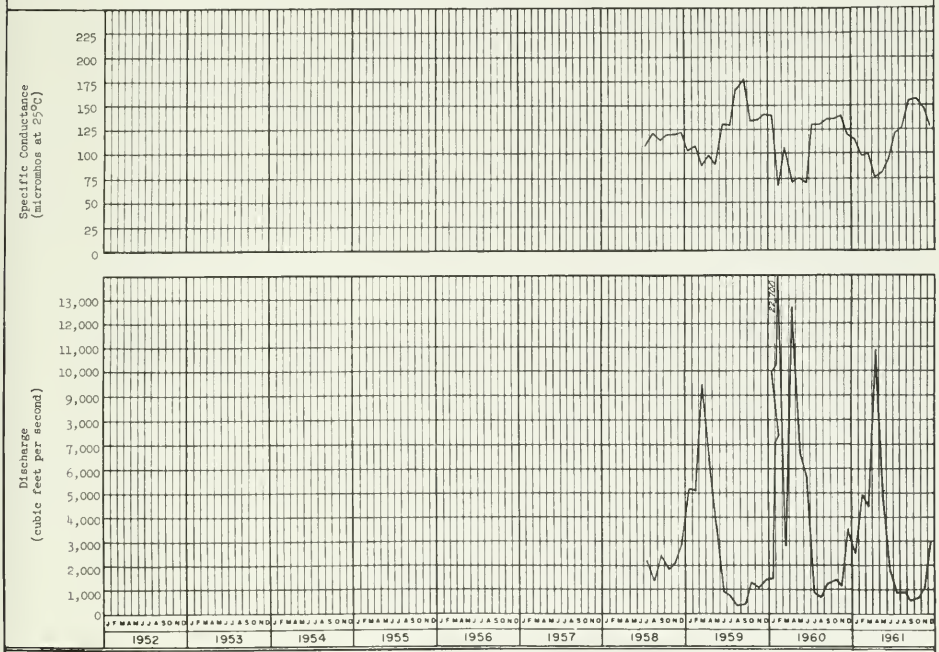
Water Quality Characteristics. The water at Station 20a is calcium to calcium-magnesium bicarbonate in character, class 1 for irrigation, soft to slightly hard, and within drinking water standards for mineral content. Comparison of quality between Station 20a and upstream stations indicate no significant changes in mineral concentrations.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	176	67.2	156	76
Temperature in °F	82	40	76	41
Dissolved oxygen in parts per million	12.6	7.3	12.6	7.3
Percent saturation	108	86	102	86
pH	7.7	7.1	7.6	7.1
Mineral constituents in parts per million				
Calcium (Ca)	18	8.0	18	9.2
Magnesium (Mg)	7.7	2.9	4.9	2.9
Sodium (Na)	7.3	1.4	5.9	1.4
Potassium (K)	2.6	0.4	1.2	0.4
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	92	29	86	40
Sulfate (SO_4)	11	0.0	6.0	3.2
Chloride (Cl)	4.8	1.0	4.8	1.0
Nitrate (NO_3)	0.9	0.0	0.3	0.0
Fluoride (F)	0.1	0.0	0.1	0.0
Boron (B)	0.2	0.0	0.1	0.0
Silica (SiO_2)	21	11	17	14
Total dissolved solids in parts per million	114	46	106	52
Percent sodium	19	8	17	8
Hardness as $CaCO_3$ in parts per million				
Total	74	27	65	34
Noncarbonate	7	0	1	0
Turbidity	150	2	30	2
Coliform in most probable number per milliliter	>7,000.	2.3	>7,000	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.61	0.0	0.24	0.0
Solid alpha	0.55	0.0	0.55	0.0
Dissolved beta	6.43	0.0	6.3	0.0
Solid beta	7.8	0.0	7.8	4.1

WATER QUALITY VARIATIONS



FEATHER RIVER BELOW SHANGHAI BEND (STA. NO. 20a)

INDIAN CREEK NEAR CRESCENT MILLS (STA. 17d)

Sampling Point. Station 17d is located in Section 25 of Township 26 North, Range 9 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the center of the channel of flow, from the Taylorsville Road bridge (0.7 mile upstream from the USGS gaging station), 1.5 miles upstream from Dixie Creek, and 1 mile south of Crescent Mills, Plumas County.

Period of Record. April 1951 through December 1961.

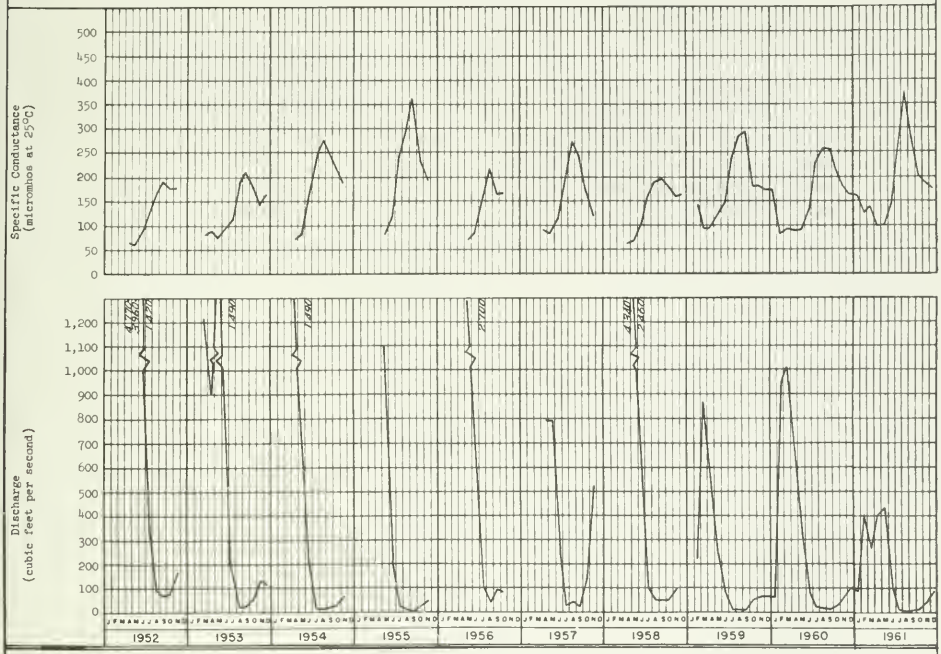
Water Quality Characteristics. Past analyses show the water to be generally calcium bicarbonate in character, class 1 for irrigation, soft to moderately hard, and within mineral requirements for drinking water. Waters at this station are consistently of excellent quality.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	37[illegible]	63.8	375	99
Temperature in °F	82	35	82	36
Dissolved oxygen in parts per million	12.6	4.7	10.9	6.0
Percent saturation	10[illegible]	48	91	58
pH	7.6	6.7	7.2	6.8
Mineral constituents in parts per million				
Calcium (Ca)	3[illegible]	6.8	30	9.6
Magnesium (Mg)	12	2.1	9.5	4.4
Sodium (Na)	21	2.7	21	3.7
Potassium (K)	1.1	0.7	1.4	0.7
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	207	36	207	55
Sulfate (SO_4)	10	0.2	10	3.0
Chloride (Cl)	14	0.0	14	0.4
Nitrate (NO_3)	1.1	0.0	0.3	0.2
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.3	0.00	0.3	0.0
Silica (SiO_2)	32	19	31	25
Total dissolved solids in parts per million	255	43	255	67
Percent sodium	34	16	28	16
Hardness as $CaCO_3$ in parts per million				
Total	147	26	147	42
Noncarbonate	6	0	0	0
Turbidity	175	0.8	45	3
Coliform in most probable number per milliliter	>7,000.	<0.045	7,000.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.51	0.00	0.51	0.[illegible]3
Solid alpha	0.83	0.00	0.49	0.0
Dissolved beta	35.41	0.00	3.2	2.4
Solid beta	28.6	0.00	9.1	2.5

WATER QUALITY VARIATIONS



INDIAN CREEK NEAR CRESCENT MILLS (STA. NO. 17d)

Yuba-Bear River Basins

The Yuba-Bear River Basins are located on the western slope of Sierra Nevada in the west-central portion of the Central Valley Region. Included within the basins are about 1,490 square miles of land ranging from rugged mountains to rolling foothills with only about 17 square miles classified as valley and mesa terrain. Estimated mean annual runoff of the drainage systems of the Yuba and Bear Rivers are 2,415,000 acre-feet and 356,000 acre-feet, respectively.

Developments in the unit are typical of mountainous areas and include lumbering, mining, resorts, recreational facilities, and livestock raising. Waste discharges from these endeavors are relatively minor. The cities of Auburn, Nevada City, and Grass Valley discharge treated wastes.

The following tabulation lists the stations maintained to monitor quality of surface water in these basins, and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Yuba River near Smartville	248
Yuba River at Marysville	250
Bear River near Wheatland	252
Bear River near Mouth	254

YUBA RIVER NEAR SMARTVILLE (STA. 21a)

Sampling Point. Station 21a is located in Section 20 of Township 16 North, Range 6 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the Highway 20 bridge, 4 miles downstream from the confluence of Deer Creek, 5 miles downstream from Narrows Dam, and 2 miles northwest of Smartville, Yuba County.

Period of Record. April 1951 through December 1961.

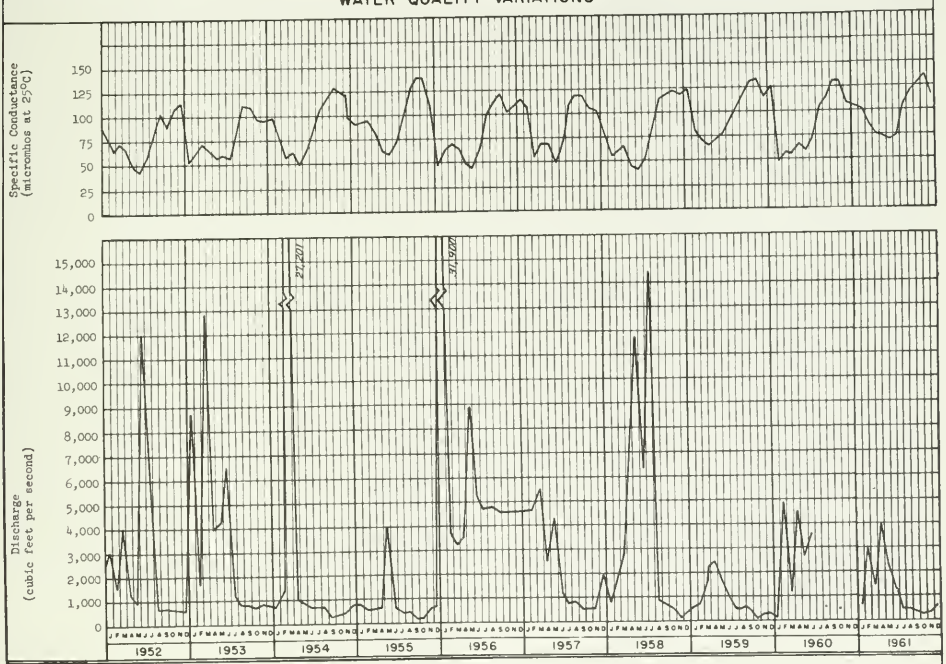
Water Quality Characteristics. Antecedent data show the water at Station 21a to be consistently of excellent quality, calcium bicarbonate in character, class 1 for irrigation, soft to slightly hard, and within drinking water standards for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	136	43.1	135	69
Temperature in °F	78	39	76	46
Dissolved oxygen in parts per million	14.0	7.5	11.9	7.6
Percent saturation	124	86	101	90
pH	8.4	6.7	7.6	7.1
Mineral constituents in parts per million				
Calcium (Ca)	18	5.2	16	9.2
Magnesium (Mg)	5.3	0.7	2.9	2.3
Sodium (Na)	5.7	1.0	3.3	1.3
Potassium (K)	1.8	0.2	1.4	0.5
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	72	21	69	39
Sulfate (SO_4)	12	1.4	6.0	4.0
Chloride (Cl)	4.0	0.0	3.2	0.0
Nitrate (NO_3)	1.2	0.0	0.1	0.0
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.5	0.00	0.1	0.0
Silica (SiO_2)	19	11	16	13
Total dissolved solids in parts per million	97	31	96	49
Percent sodium	23	8	14	8
Hardness as $CaCO_3$ in parts per million				
Total	63	17	61	30
Noncarbonate	44	0	5	0
Turbidity	190	0	15	0
Coliform in most probable number per milliliter	>7,000.	0	620	<0.045
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.67	0.00	0.24	0.15
Solid alpha	0.8	0.00	0.23	0.0
Dissolved beta	9.04	0.00	5.5	0.0
Solid beta	10.8	0.00	8.8	0.0

WATER QUALITY VARIATIONS



YUBA RIVER NEAR SMARTVILLE (STA. NO. 21a)

YUBA RIVER AT MARYSVILLE (STA. 21)

Sampling Point. Station 21 is located in Section 18 of Township 15 North, Range 4 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the center of the channel of flow, from Simpson Lane bridge, approximately 1 mile upstream from the confluence with the Feather River, in Yuba County.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. The water at Station 21 is calcium bicarbonate in character, class 1 for irrigation, soft to slightly hard, and within drinking water standards for mineral content. There was no significant difference noted in the quality of water at Station 21 and the upstream station (21a) near Smartville.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	204	44	188	76
Temperature in °F	83	38	78	44
Dissolved oxygen in parts per million	14.5	7.4	12.5	8.0
Percent saturation	132	84	108	92
pH	8.0	6.6	7.6	7.1
Mineral constituents in parts per million				
Calcium (Ca)	20	5.2	20	9.1
Magnesium (Mg)	6.6	1.1	6.6	2.9
Sodium (Na)	6.0	1.1	4.1	1.1
Potassium (K)	1.8	0.1	0.5	0.4
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	96	22	84	34
Sulfate (SO_4)	17	0.0	17	3.6
Chloride (Cl)	5.3	0.0	3.6	0.0
Nitrate (NO_3)	1.4	0.0	0.1	0.0
Fluoride (F)	0.1	0.0	0.1	0.0
Boron (B)	0.28	0.00	0.1	0.6
Silica (SiO_2)	21	10	20	12
Total dissolved solids in parts per million	141	30	130	51
Percent sodium	19	7	12	7
Hardness as $CaCO_3$ in parts per million				
Total	96	18	86	33
Noncarbonate	17	0	17	0
Turbidity	300	0	20	0
Coliform in most probable number per milliliter	>7,000.	0.13	62.	0.23
Radioactivity in micro-micro curies par liter				
Dissolved alpha	0.45	0.00	0.08	0.0
Solid alpha	2.15	0.00	0.16	0.0
Dissolved beta	20.68	0.00	1.4	0.0
Solid beta	5.5	0.00	5.5	0.0

WATER QUALITY VARIATIONS

YUBA RIVER AT MARYSVILLE (STA. NO. 21)

BEAR RIVER NEAR WHEATLAND (STA. 78)

Sampling Point. Station 78 is located in Section 3 of Township 13 North, Range 5 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank at the USGS gaging station near U. S. Highway 99E bridge, 1 mile southeast of Wheatland, Placer County.

Period of Record. December 1951 through December 1961.

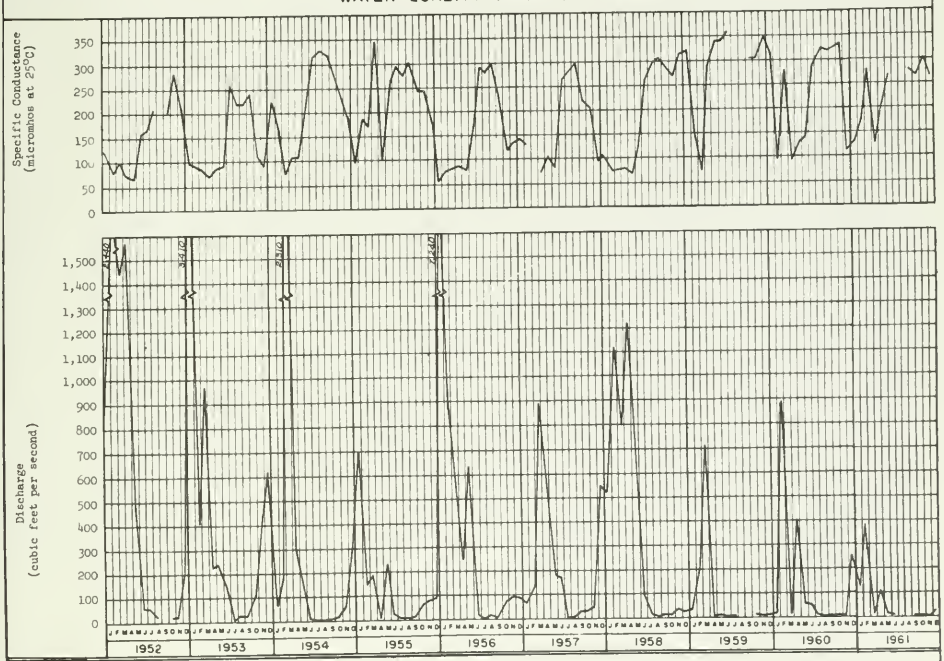
Water Quality Characteristics. The water at this station is calcium-magnesium bicarbonate in character, consistently class 1 for irrigation, in the soft to moderately hard range, and within drinking water requirements for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	356	57.5	301	123
Temperature in °F	92	37	85	42
Dissolved oxygen in parts per million	16.0	6.1	12.4	8.0
Percent saturation	144	75	120	86
pH	8.3	6.8	8.0	7.5
Mineral constituents in parts per million				
Calcium (Ca)	37	6.0	27	21
Magnesium (Mg)	20	1.9	15	8.9
Sodium (Na)	14	1.6	7.4	1.7
Potassium (K)	2.6	0.3	1.8	0.7
Carbonate (CO_3)	8	0	3	0
Bicarbonate (HCO_3)	158	24	139	50
Sulfate (SO_4)	39	5.8	24	21
Chloride (Cl)	16	0.9	13	3.0
Nitrate (NO_3)	1.4	0.0	0.3	0.0
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.69	0.00	0.0	0.0
Silica (SiO_2)	23	10	19	16
Total dissolved solids in parts per million	226	36	191	78
Percent sodium	29	4	15	6
Hardness as $CaCO_3$ in parts per million				
Total	173	24	143	55
Noncarbonate	52	0	36	10
Turbidity	3,400	0.2	30	1
Coliform in most probable number per milliliter	7,000.	<.045	230.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.65	0.00	0.08	0.0
Solid alpha	0.43	0.00	0.37	0.0
Dissolved beta	8.79	0.00	1.8	1.2
Solid beta	8.1	0.00	0.3	0.0

WATER QUALITY VARIATIONS



BEAR RIVER NEAR WHEATLAND (STA. NO. 78)

BEAR RIVER NEAR MOUTH (STA. 20b)

Sampling Point. The station near the mouth of the Bear River is located in Section 20 of Township 13 North, Range 4 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected at Highway 24 bridge (Feather River Boulevard) at Rio Oso, Sutter County.

Period of Record. November 1958 through December 1961.

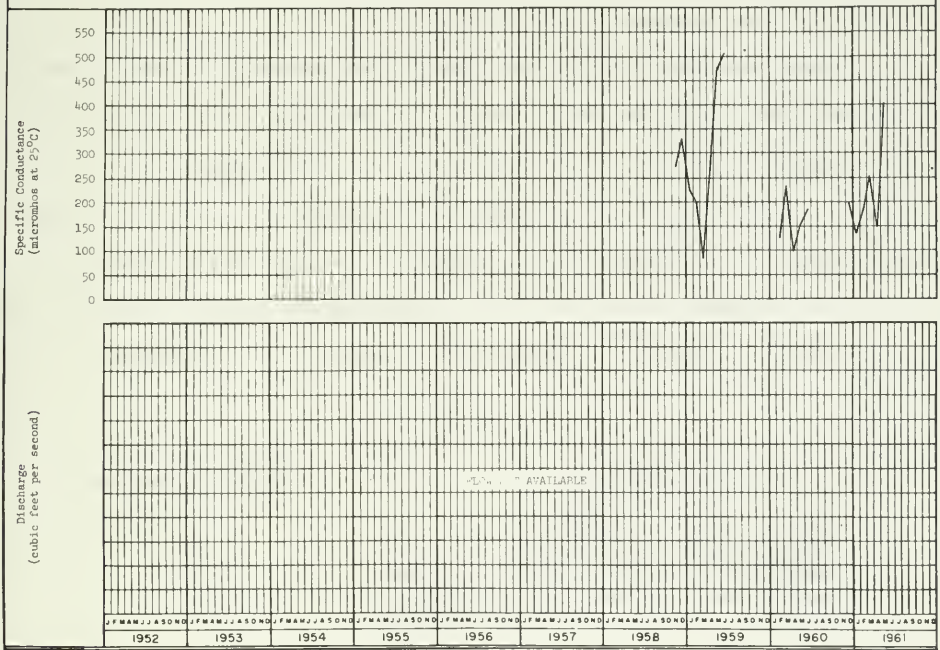
Water Quality Characteristics. The water at Station 20b is calcium-magnesium bicarbonate in character, slightly to moderately hard, class 1 for irrigation, and within drinking water requirements for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	513	84.0	401	136
Temperature in °F	83	39	65	39
Dissolved oxygen in parts per million	12.4	7.3	12.4	9.2
Percent saturation	106	68	104	86
pH	8.1	7.1	8.1	7.1
Mineral constituents in parts per million				
Calcium (Ca)	35	8.8	28	
Magnesium (Mg)	23	2.9	16	
Sodium (Na)	42	2.8	30	2.8
Potassium (K)	8.1	0.4	6.5	
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	213	30	139	63
Sulfate (SO_4)	50	11	24	
Chloride (Cl)	66	3.0	43	3.0
Nitrate (NO_3)	1.8	0.0	0.4	
Fluoride (F)	0.4	0.0	0.4	
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	58	10	35	
Total dissolved solids in parts per million	334	56	251	87
Percent sodium	37	8	31	8
Hardness as $CaCO_3$ in parts per million				
Total	180	34	134	59
Noncarbonate	51	3	31	7
Turbidity	50	3	45	4
Coliform in most probable number per milliliter				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.51	0.00	0.15	
Solid alpha	0.54	0.10	0.30	
Dissolved beta	15.76	2.28	3.8	
Solid beta	5.0	0.00	5.0	

WATER QUALITY VARIATIONS



BEAR RIVER AT MOUTH (STA. NO. 20b)

American River Basin

The American River Basin drains the southeast corner of the Sacramento River Valley Basin of the Central Valley and encompasses approximately 1,920 square miles of the western slope of the Sierra Nevada. The basin is characterized by foothill and mountainous terrain with elevations ranging from 150 to 10,000 feet. Valley and mesa land comprise only 20 square miles in the basin. Mean annual runoff is estimated to be about 2,774,000 acre-feet in the American River drainage basin.

The basin is favored by forest, mineral, and recreational resources, which have all been developed for economic return. Although valley and mesa land comprise only about one percent of the area, considerable orchard acreage is found in the foothills and on the lower mountain slopes. These developments, along with numerous irrigation and municipal diversions for use in the valley, are the main water users in this watershed.

Waste discharges from several communities, primarily in the Sacramento Metropolitan area, enter the American River. Placerville is the only waste discharge in excess of 0.5 mgd in the upper reaches of the drainage basin. In the lower reach of the river, there are four waste discharges in excess of 0.5 mgd, Folsom Prison, City of Folsom, and two Sacramento County sanitary districts.

The following tabulation lists the stations maintained to monitor quality of surface water in this basin, and the page on which each is discussed.

AMERICAN RIVER AT NIMBUS DAM (STA. 22a)

Sampling Point. Station 22a is located in Section 16, Township 9 North, Range 7 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank just downstream from the fish screen at Nimbus Fish Hatchery, about 10 miles east of Sacramento, Sacramento County.

Period of Record. November 1958 through December 1961.

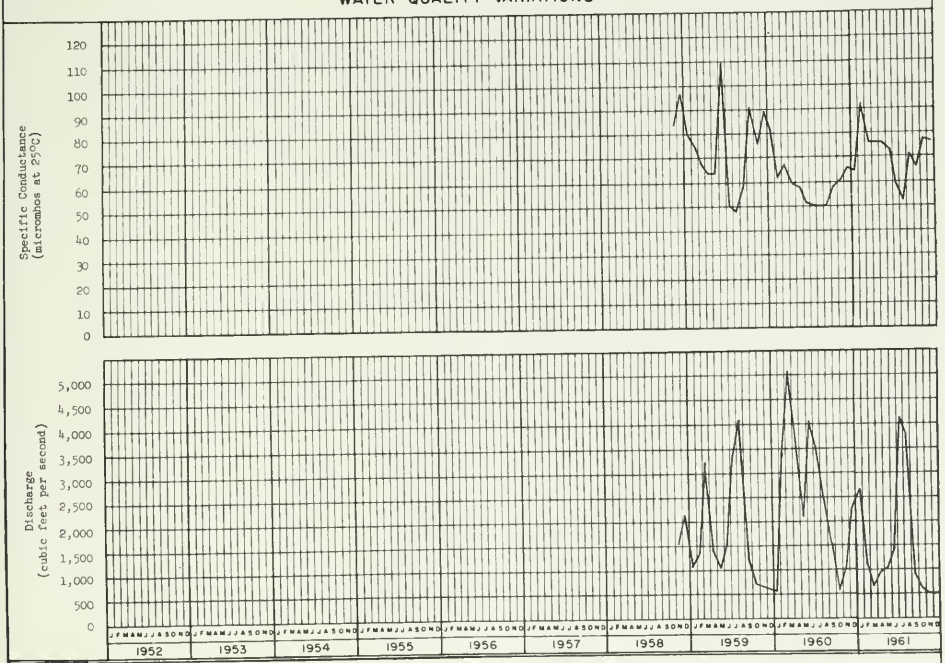
Water Quality Characteristics. Past analyses show the water to be a calcium bicarbonate type and of excellent mineral quality. From a mineral standpoint, the water is suitable for domestic use, soft, and class 1 for irrigation.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	110	48.2	92.0	52
Temperature in °F	71	48	71	49
Dissolved oxygen in parts per million	12.5	6.5	11.3	8.5
Percent saturation	120	67	109	89
pH	7.6	6.8	7.6	7.0
Mineral constituents in parts per million				
Calcium (Ca)	13	4.8	8.1	8.0
Magnesium (Mg)	3.5	0.7	2.6	1.9
Sodium (Na)	4.5	1.3	3.1	1.3
Potassium (K)	3.3	0.3	3.3	0.7
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	42	23	42	23
Sulfate (SO_4)	5.8	1.0	4.0	2.0
Chloride (Cl)	12	0.7	6.0	0.7
Nitrate (NO_3)	0.5	0.0	0.1	0.1
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.2	0.0	0.2	0 0
Silica (SiO_2)	18	8.5	12	9.1
Total dissolved solids in parts per million	69	33	61	35
Percent sodium	22	9	19	9
Hardness as $CaCO_3$ in parts per million				
Total	44	19	40	20
Noncarbonate	11	0	6	0
Turbidity	140	1	8	2
Coliform in most probable number per milliliter	>7,000.	0.23	>7,000.	<0.45
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.33	0.0	0.16	0.0
Solid alpha	0.77	0.00	0.0	0.00
Dissolved beta	4.7	0.4	0.8	0.4
Solid beta	3.66	0.00	2.5	0.0

WATER QUALITY VARIATIONS



AMERICAN RIVER AT NIMBUS DAM (STA. NO. 22a)

AMERICAN RIVER AT SACRAMENTO (STA. 22)

Sampling Point. Station 22 on the American River is located in Section 3, Township 8 North, Range 5 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected at midstream from H Street bridge in Sacramento, Sacramento County.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Water at Station 22 is calcium bicarbonate in character. The mineral quality is excellent, soft, and very similar to that at Station 22a (American River at Nimbus Dam). The criteria for class 1 irrigation water and mineral constituents for domestic use are consistently met by water at this station. Since 1956, when regulation of flow by Folsom Dam was initiated, the quality of water has been uniform perenially. The maximum values for concentration of individual constituents during the period of record all occurred prior to 1956.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	129	24	81	44
Temperature in °F	81	41	72	46
Dissolved oxygen in parts per million	14.2	5.3	11.2	8.2
Percent saturation	124	59	104	83
pH	8.3	6.7	7.7	7.0
Mineral constituents in parts per million				
Calcium (Ca)	12	3.4	8.4	6.8
Magnesium (Mg)	5.5	0.7	2.3	1.7
Sodium (Na)	5.1	1.1	3.4	1.6
Potassium (K)	1.3	0.1	1.0	0.7
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	54	16	36	24
Sulfate (SO_4)	4.7	0.0	4.0	2.0
Chloride (Cl)	10	0.0	5.2	1.2
Nitrate (NO_3)	0.9	0.0	0.4	0.2
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.17	0.00	0.1	0.0
Silica (SiO_2)	15	6.9	12	8.5
Total dissolved solids in parts per million	91	17	58	38
Percent sodium	33	9	19	9
Hardness as $CaCO_3$ in parts per million				
Total	50	10	34	20
Noncarbonate	10	0	5	0
Turbidity	140	0	9	0
Coliform in most probable number per milliliter	>7,000.	0.06	>7,000.	<0.45
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.50	0.00	0.12	0.08
Solid alpha	0.69	0.00	0.41	0.06
Dissolved beta	15.92	0.00	5.9	1.8
Solid beta	7.89	0.00	4.0	0.0

WATER QUALITY VARIATIONS

AMERICAN RIVER AT SACRAMENTO (STA. NO. 22)

MIDDLE FORK AMERICAN RIVER NEAR AUBURN (STA. 22b)

Sampling Point. Station 22b is located in Section 6, Township 12 North, Range 9 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank, adjacent to the USGS gaging station, 1.9 miles upstream from the confluence with North Fork, and 3.5 miles northeast of Auburn, Placer County.

Period of Record. July 1958 through December 1961.

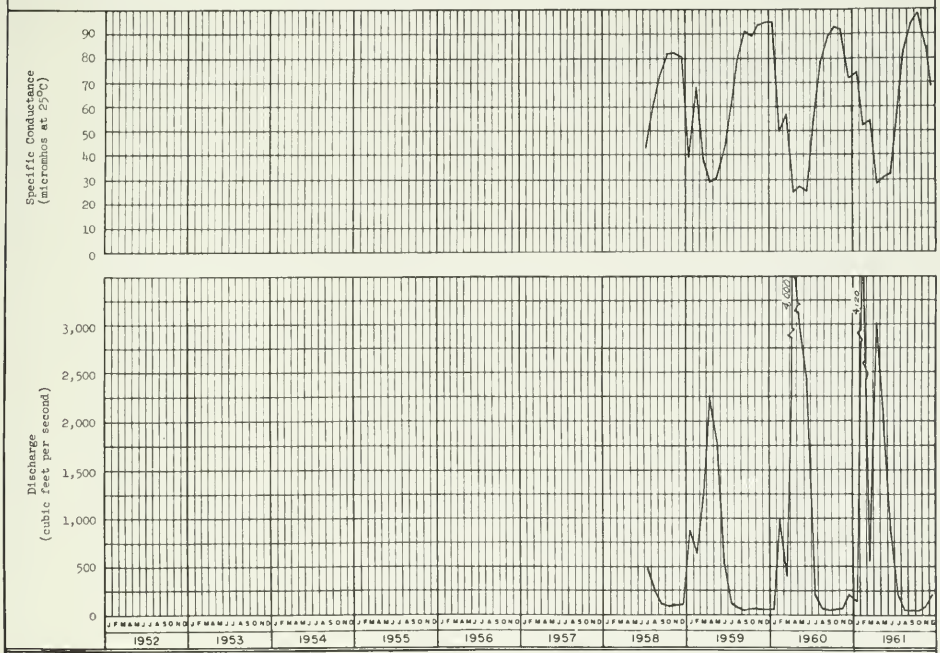
Water Quality Characteristics. Past analyses show the water to be excellent in quality, calcium bicarbonate type, with very low concentrations of dissolved solids. The water consistently meets requirements for class 1 irrigation water as well as mineral standards for domestic use, and is soft with a maximum of record hardness of 40 ppm.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	98	24.7	98	24
Temperature in °F	80	36	70	36
Dissolved oxygen in parts per million	13.2	7.6	12.7	8.3
Percent saturation	119	80	100	92
pH	7.5	6.8	7.4	7.0
Mineral constituents in parts per million				
Calcium (Ca)	11	2.0	11	3.4
Magnesium (Mg)	2.9	0.1	2.3	0.9
Sodium (Na)	4.3	0.6	3.6	0.6
Potassium (K)	0.9	0.0	0.9	0.5
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	45	12	45	13
Sulfate (SO_4)	9.6	0.0	4.0	0.0
Chloride (Cl)	7.8	0.6	7.8	0.6
Nitrate (NO_3)	0.4	0.0	0.1	0.0
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	14	8.8	13	8.9
Total dissolved solids in parts per million	75	19	75	21
Percent sodium	26	11	26	11
Hardness as $CaCO_3$ in parts per million				
Total	40	9	37	12
Noncarbonate	12	0	8	0
Turbidity	200	0.2	200	1
Coliform in most probable number per milliliter	230.	0.06	230.	0.06
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.93	0.00	0.39	0.0
Solid alpha	0.44	0.0	0.31	0.0
Dissolved beta	2.96	0.0	0.0	0.0
Solid beta	1.58	0.0	0.0	0.0

WATER QUALITY VARIATIONS



AMERICAN RIVER, MIDDLE FORK NEAR AUBURN (STA. NO. 22b)

SOUTH FORK AMERICAN RIVER NEAR LOTUS (STA. 22c)

Sampling Point. The station on South Fork American River is located in Section 11, Township 11 North, Range 9 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, opposite the USGS gaging station located 0.4 mile downstream from the confluence of Greenwood Creek, and 2.4 miles northwest of Lotus, El Dorado County.

Period of Record. July 1958 through December 1961.

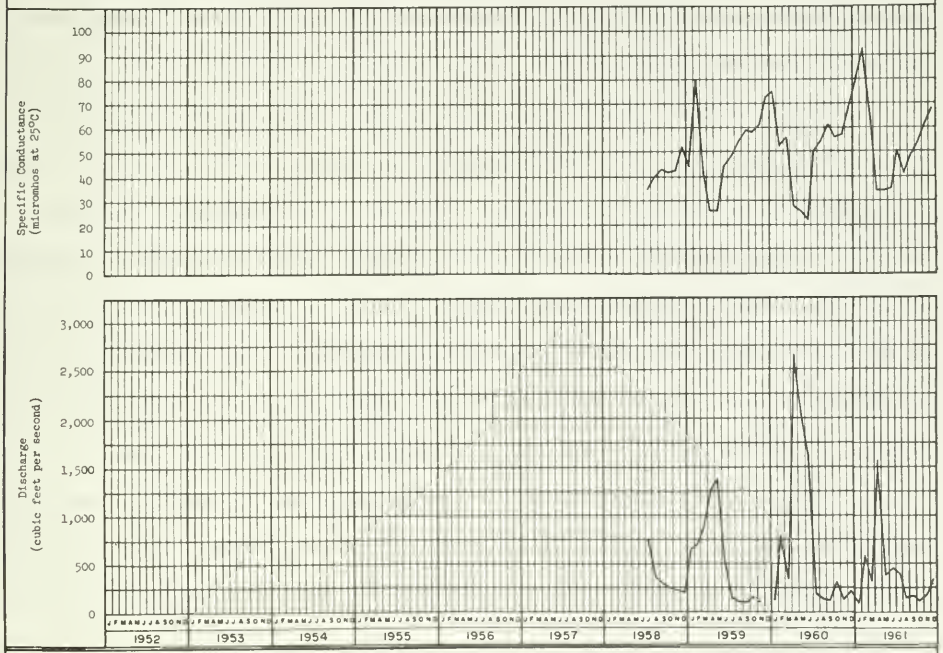
Water Quality Characteristics. Samples from Station 22c indicate the principal cation to be calcium, and bicarbonate as the principal anion. The water is consistently of excellent quality, meets requirements for class 1 irrigation as well as mineral standards for domestic use, and is soft with a maximum of record hardness of 39 ppm.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	92.9	22.0	92.9	34
Temperature in °F	78	34	69	36
Dissolved oxygen in parts per million	13.3	7.3	12.2	8.2
Percent saturation	102	83	101	88
pH	7.6	7.0	7.6	7.0
Mineral constituents in parts per million				
Calcium (Ca)	6.4	1.8	5.2	4.4
Magneeium (Mg)	4.6	0.0	1.0	0.0
Sodium (Ns)	4.3	0.9	3.6	0.9
Potassium (K)	1.9	0.3	0.6	0.3
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	52	11	52	16
Sulfate (SO_4)	4.8	0.0	0.0	0.0
Chloride (Cl)	7.2	0.4	5.0	0.8
Nitrate (NO_3)	1.2	0.0	1.0	0 0
Fluoride (F)	0.1	0.0	0.1	0.0
Boron (B)	0.5	0.0	0.1	0.0
Silice (SiO_2)	16	8	9.5	8.1
Total dissolved solids in parts per million	74	17	74	27
Percent sodium	32	12	32	12
Hardness as $CaCO_3$ in parts per million				
Total	39	8	39	11
Noncarbonate	8	0	8	0
Turbidity	35	1	25	2
Coliform in most probable number per milliliter	>7,000.	<0.045	620.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.17	0.00	0.16	0.0
Solid alpha	0.76	0.0	0.31	0.0
Dissolved beta	4.40	0.0	0.0	0.0
Solid beta	5.62	0.0	3.3	0.0

WATER QUALITY VARIATIONS



AMERICAN RIVER, SOUTH FORK NEAR LOTUS (STA. NO. 22c)

San Joaquin River Valley Subregion (5b)

San Joaquin River Valley Subregion occupies the south-central portion of the Central Valley Region. Boundaries of the basin are defined by the ridge of the Sierra Nevada on the east, the divide between the Tulare Lake Basin and San Joaquin River on the south, the crest of the Coast Range on the west, and the San Joaquin Delta and Mokelumne River Basin on the north. Average east-west width of the subregion is about 130 miles, and average north-south length also is about 130 miles. The subregion boundaries enclose about 12,000 square miles of which about 8,000 square miles are mountainous and foothills.

Between the alluvial fans and foothills of the Coast and Sierra Nevada Mountains lies the broad San Joaquin Valley. Within the subregion, San Joaquin Valley comprises 95 percent of the land classified as valley and mesa area. The main valley floor encompasses about 3,670 square miles of fertile agricultural lands with elevations varying from almost sea level in the lower end to about 300 feet at the base of the foothills.

Major streams, all of which head in the Sierra Nevada on the east, include Fresno, Chowchilla, Merced, Tuolumne, and Stanislaus Rivers. These rivers drain rugged mountainous terrain with elevations often exceeding 10,000 feet. There are no major streams draining the relatively barren foothills and mountains on the west, however, samples taken from the west side streams indicate that they are more mineralized than those draining the east side of the valley and, at certain stages of flow, are of poor quality. Natural mean seasonal runoff from the subregion is estimated to be slightly less than 6.5 million acre-feet.

Nineteen sampling stations are being monitored to provide a continuing check on the quality of surface water resources in San Joaquin River Valley Subregion. Monitored streams, with the number of stations in parentheses, are as follows:

San Joaquin River Unit (9)
Fresno River Basin (1)
Chowchilla River and Bear Creek Unit (2)
Merced River Basin (2)
Tuolumne River Basin (3)
Stanislaus River Basin (2)

During 1960 and 1961, the quality of water at all but one station on the lower San Joaquin River was significantly degraded by irrigation return waters and effluent ground waters coupled with a lack of sufficient diluting waters from its tributaries. The waters were seldom of a quality better than class 2, and were frequently class 3 for irrigation. Maximum concentrations of record for many constituents were established at all but one of the five downstream stations on the river. Similarly, but to a lesser extent, the waters of the lower reaches of the three principal tributary streams, the Merced, Tuolumne, and Stanislaus Rivers, also showed new maximums on some constituents. However, the Tuolumne River in those reaches near the confluence with the San Joaquin River were class 2 for irrigation a great deal of the time.

San Joaquin River Unit

The San Joaquin River Unit includes the following watersheds: all land below the Sierra Nevada foothill line to the east, drainage basins of minor tributary streams and the valley floor to the west, and the headwaters of the San Joaquin River. Valley and mesa lands encompass about 4,000 square miles in the unit, with over 95 percent of this type land being on the floor of San Joaquin Valley. Mountains and foothills comprise more than 10,000 square miles, with over 60 percent of the lands in this group located in the Coast Range. Mean seasonal runoff from this unit is slightly in excess of three million acre-feet.

Topography of the unit is highly variable. West side terrain is hilly and generally of a rolling nature with elevations varying from about 500 feet to slightly over 3,000 feet above sea level. The valley floor is comparatively level and is marred only by stream channels or draws. In contrast, the San Joaquin River basin in the Sierra Nevada is extremely rugged and drains areas with elevations in excess of 10,000 feet.

Agriculture dominates commercial activities within the unit. Mining, natural gas, lumber production in the Sierra Nevada, livestock raising, and light industry all have a role in the economy. Agriculture is pre-eminent, however, and is by far the largest user of water resources.

Most wastes of significant magnitude in this unit are discharged to land. Only that discharged by the City of Turlock (3.3 mgd) directly enters the San Joaquin River. Controls have been established to prevent wastes in the unit from becoming major impairment problems. However, irrigation return flows pose a threat to water quality in the San Joaquin River.

Eight surface water quality monitoring stations are maintained in this unit. The following tabulation presents the name of the monitoring stations, and indicates the page on which each is discussed:

SAN JOAQUIN RIVER AT FRIANT (STA. 24)

Sampling Point. Station 24 is the most upstream monitoring station on the San Joaquin River, located in Section 7, Township 11 South, Range 21 East, Mt. Diablo Base and Meridian, in Fresno County. Monthly grab samples were collected from the left bank, 100 feet downstream from the USGS gage house, about 2 miles downstream from Friant Dam, and 0.5 mile west of Friant.

Period of Record. April 1951 through December 1961.

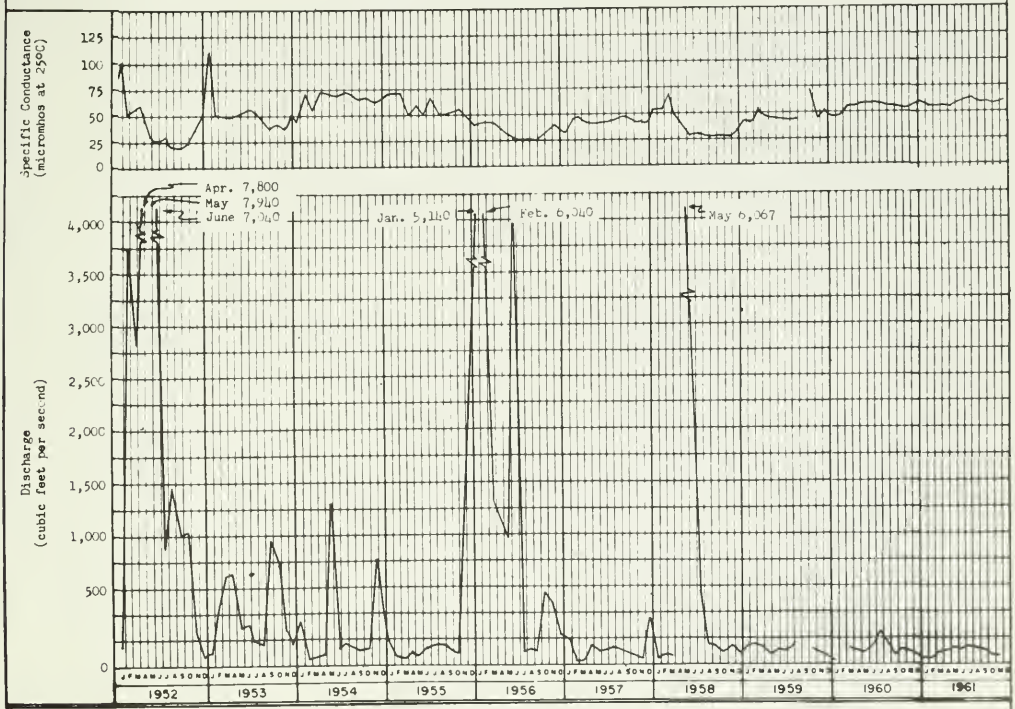
Water Quality Characteristics. Samples collected from San Joaquin River at Friant generally have indicated a calcium-sodium bicarbonate characteristic. Mineral quality has been excellent with a maximum recorded total dissolved solids concentration of 87 ppm. Waters have been soft, and concentrations of minerals, included within the standard mineral and heavy metals determinations, consistently have been within limits recommended for drinking water. These waters also have continually been categorized as class 1 (excellent to good) for irrigation use.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	108	21	64	55.5
Temperature in °F	64	35	61	47
Dissolved oxygen in parts per million	13.7	8.1	12.9	8.1
Percent saturation	129	73	129	73
pH	8.8	6.2	7.5	6.9
Mineral constituents in parts per million				
Calcium (Ca)	8.4	1.9	3.6	3.6
Magnesium (Mg)	2.3	0.0	1.7	1.6
Sodium (Na)	8.7	0.7	5.5	3.0
Potassium (K)	4.1	0.5	0.8	0.7
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	44	8	29	18
Sulfate (SO_4)	5.8	0.0	1.0	0.0
Chloride (Cl)	8.0	0.0	6.5	3.5
Nitrate (NO_3)	2.8	0.0	0.4	0.3
Fluoride (F)	0.3	0.0	0.1	0.1
Boron (B)	0.34	0.0	0.1	0.0
Silica (SiO_2)	15	7.4	14	10
Total dissolved solids in parts per million	87	17	52	40
Percent sodium	52	25	43	28
Hardness as $CaCO_3$ in parts per million				
Total	30	6	20	14
Noncarbonate	9	0.0	5	0.0
Turbidity	70	0.0	10	1
Coliform in most probable number per milliliter	7,000.	0.045	7,000.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.89	0.00	0.16	0.0
Solid alpha	1.67	0.00	0.49	0.03
Dissolved beta	15.01	0.00	4.0	3.2
Solid beta	14.2	0.00	8.1	2.1

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER AT FRIANT (STA. NO. 24)

SAN JOAQUIN RIVER NEAR MENDOTA (STA. 25)

Sampling Point. The Mendota station is located in Section 7, Township 13 South, Range 15 East, Mt. Diablo Base and Meridian, in Fresno County. Monthly grab samples were collected from the left bank, at the foot of the USGS gage house, 2.5 miles downstream from Mendota Dam, and 4 miles north of Mendota.

Period of Record. April 1951 through December 1961.

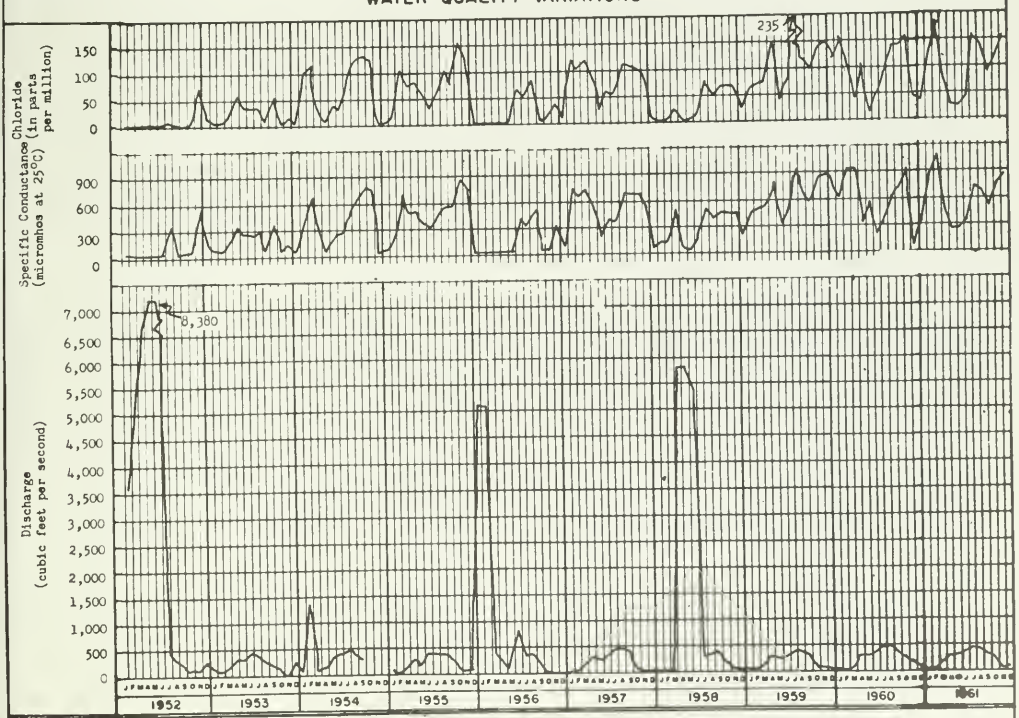
Water Quality Characteristics. Inasmuch as most of the water impounded by Mendota Dam is imported from the Sacramento-San Joaquin Delta via the Delta-Mendota Canal, water at the station is not necessarily representative of the natural quality of San Joaquin River. Water from this station does not exhibit any consistent predominance of a specific cation or anion. Principal cations are sodium and calcium, while bicarbonate and chloride frequently are the dominant anions. Based on mineral concentrations, the water is good to excellent for irrigation use, moderately hard and occasionally harder than desirable for domestic use.

Significant Water Quality Changes. New maximums of record for specific conductance and for the concentration of boron were established in 1961.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,080	31	1,080	260
Temperature in °F	88	42	79	47
Dissolved oxygen in parts per million	18.2	7.2	12.0	7.4
Percent saturation	156	81	121	81
pH	8.7	6.8	8.3	7.5
Mineral constituents in parts per million				
Calcium (Ca)	47	2.9	20	17
Magnesium (Mg)	27	0.9	16	9.0
Sodium (Na)	131	2.7	109	22
Potassium (K)	4.4	0.6	3.2	0.9
Carbonate (CO_3)	0.0	0.0	1	0.0
Bicarbonate (HCO_3)	158	14	150	81
Sulfate (SO_4)	65	1.0	41	27
Chloride (Cl)	235	0.4	171	24
Nitrate (NO_3)	1.9	0.0	1.0	0.9
Fluoride (F)	0.4	0.0	0.2	0.0
Boron (B)	0.6	0.0	0.6	0.1
Silica (SiO_2)	31	5.9	17	15
Total dissolved solids in parts per million	753	18	624	162
Percent sodium	65	32	62	38
Hardness as $CaCO_3$ in parts per million				
Total	214	8	254	77
Noncarbonate	151	0.0	151	10
Turbidity	170	0.0	120	3
Coliform i.. most probable number per milliliter	7,000.	0.13	620.	0.13
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.13	0.00	0.27	0.24
Solid alpha	1.67	0.00	0.97	0.33
Dissolved beta	10.41	0.00	1.4	0.7
Solid beta	14.5	0.00	0.5	0.0

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER NEAR MENDOTA (STA. NO. 25)

SAN JOAQUIN RIVER AT FREMONT FORD BRIDGE (STA. 25c)

Sampling Point. Station 25c is located in Section 24 of Township 7 South, Range 9 East, Mt. Diablo Base and Meridian, in Merced County. Monthly grab samples were collected from the center of the channel of flow, from Fremont Ford highway bridge, 2.1 miles downstream from Salt Slough, 4.5 miles west of Stevinson, and 6.7 miles upstream from Merced River.

Period of Record. July 1955 through December 1961.

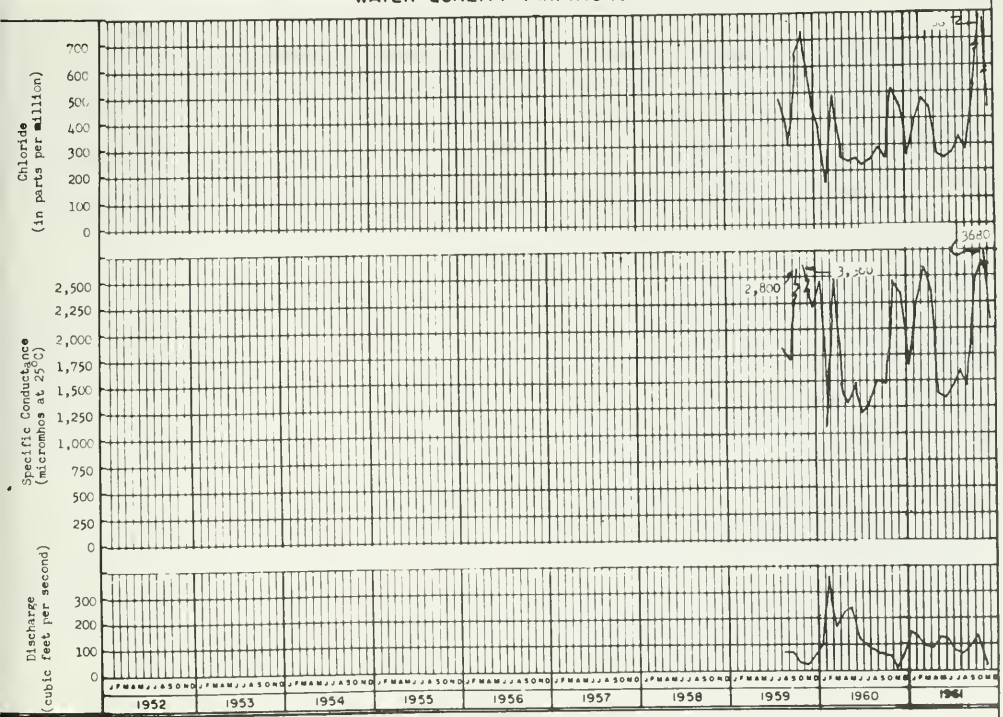
Water Quality Characteristics. Water at Station 25c ranges from sodium-chloride to sodium-calcium chloride-sulfate in character. Chloride and sulfate concentrations frequently exceed the recommended limit for domestic use. Chlorides, boron, and dissolved solids are normally in concentrations sufficient to cause the water to be class 2 or 3 for irrigation. The poor quality water has been attributed to ground water accretions and drainage flows tributary to the San Joaquin River above this sampling station, and to the fact that during a number of months in almost every year there is insufficient diluting flow from Station 25 near Mendota to this point, a reach of some 75 miles. These degrading influences cause a significant increase (on the order of 1,400 micromhos) in the concentration of dissolved minerals between the two stations.

Significant Water Quality Changes. The water at this station was class 2 or class 3 for irrigation throughout 1960 and 1961.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	5,410	103	3,680	1,340
Temperature in °F	85	42	79	47
Dissolved oxygen in parts per million	12.4	6.0	12.4	6.0
Percent saturation	152	83	130	66
pH	8.5	6.6	8.2	7.5
Mineral constituents in parts per million				
Calcium (Ca)	248	8.8	66	60
Magnesium (Mg)	150	1.5	35	33
Sodium (Na)	730	8.6	508	164
Potassium (K)	8.4	1.5	4.4	2.8
Carbonate (CO_3)	0.3	0.0	0.0	0.0
Bicarbonate (HCO_3)	291	37	291	182
Sulfate (SO_4)	760	4.8	432	140
Chloride (Cl)	1,330	5.8	868	250
Nitrate (NO_3)	28	0.0	4.1	1.6
Fluoride (F)	0.5	0.0	0.3	0.0
Boron (B)	1.8	0.0	1.8	0.5
Silica (SiO_2)	37	0.2	23	19
Total dissolved solids in parts per million	3,350	67	2,145	780
Percent sodium	63	34	63	54
Hardness as $CaCO_3$ in parts per million				
Total	1,240	28	755	290
Noncarbonate	1,090	0.0	575	121
Turbidity	150	20	150	20
Coliform in most probable number per milliliter	7,000.	0.23	1,300.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.67	0.09	0.67	0.60
Solid alpha	0.68	0.00	0.68	0.21
Dissolved beta	14.21	0.00	5.2	0.0
Solid beta	7.27	0.00	0.7	0.0

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER AT FREMONT FORT BRIDGE (STA. NO. 25c)

SAN JOAQUIN RIVER AT HILLS FERRY BRIDGE (STA. 25b)

Sampling Point. Station 25b is located in Section 3 of Township 7 South, Range 9 East, Mt. Diablo Base and Meridian, in Stanislaus County. Monthly grab samples were collected from the left bank of Hills Ferry Bridge, 300 feet downstream from Merced River, and 3.5 miles northeast of Newman.

Period of Record. October 1958 through December 1961.

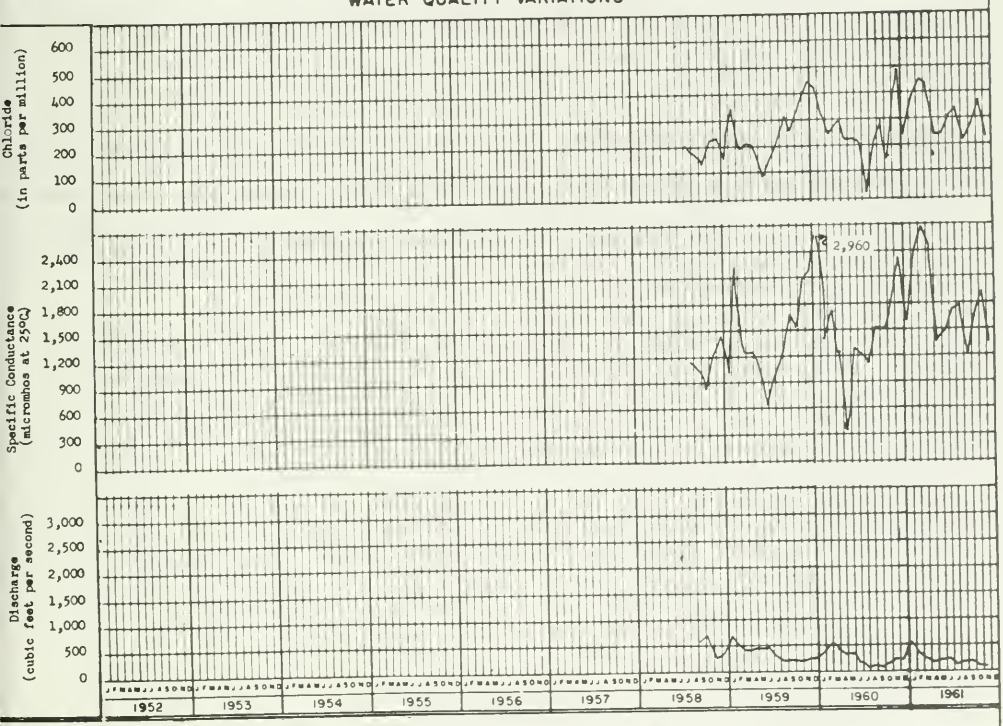
Water Quality Characteristics. The characteristics of the water at this station are largely dependent on the diluting effects of the Merced River which enters a short distance upstream. In general, the water is sodium-chloride in character. It ranges from class 1 to class 3 for irrigation, again depending on dilution from the Merced River. Similarly, hardness varies considerably. Occasionally, dissolved solids and chlorides exceed the recommended limits for domestic use.

Significant Water Quality Changes. Maximum values of record for a number of mineral constituents were established in 1960 and 1961. Throughout this period the water was class 2 or class 3 for irrigation, and was quite similar in quality to that at Fremont Ford Bridge which is about 7 miles upstream from this station.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	2,960	610	2,680	1,200
Temperature in °F	82	42	80	48
Dissolved oxygen in parts per million	13.0	6.3	13.0	7.7
Percent saturation	146	70	136	80
pH	8.2	7.1	8.2	7.5
Mineral constituents in parts per million				
Calcium (Ca)	92	32	61	52
Magnesium (Mg)	42	14	33	29
Sodium (Na)	388	75	368	138
Potassium (K)	6.0	2.6	4.4	3.4
Carbonate (CO_3)	4	0.0	0.0	0.0
Bicarbonate (HCO_3)	286	140	279	179
Sulfate (SO_4)	470	69	470	85
Chloride (Cl)	490	82	449	212
Nitrate (NO_3)	4.9	0.0	3.2	1.8
Fluoride (F)	0.5	0.1	0.3	0.3
Boron (B)	1.9	0.2	1.9	0.4
Silica (SiO_2)	33	14	24	18
Total dissolved solids in parts per million	1,680	372	1,520	634
Percent sodium	64	53	61	54
Hardness as $CaCO_3$ in parts per million				
Total	560	139	516	228
Noncarbonate	322	23	322	70
Turbidity	150	6	68	10
Coliform in most probable number per milliliter	7,000.	0.23	2,400.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.61	0.00	0.36	0.17
Solid alpha	0.94	0.00	0.94	0.0
Dissolved beta	11.79	0.00	2.4	0.0
Solid beta	6.42	0.00	0.0	0.0

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER AT HILLS FERRY BRIDGE (STA. NO. 25b)

SAN JOAQUIN RIVER NEAR GRAYSON (STA. 26)

Sampling Point. The Grayson monitoring station is located within Section 24, Township 4 South, Range 7 East, Mt. Diablo Base and Meridian, in Stanislaus County. Monthly grab samples were collected from the left bank, adjacent to Laird Slough Bridge, and 2 miles northeast of Westley.

Period of Record. April 1959 through December 1961.

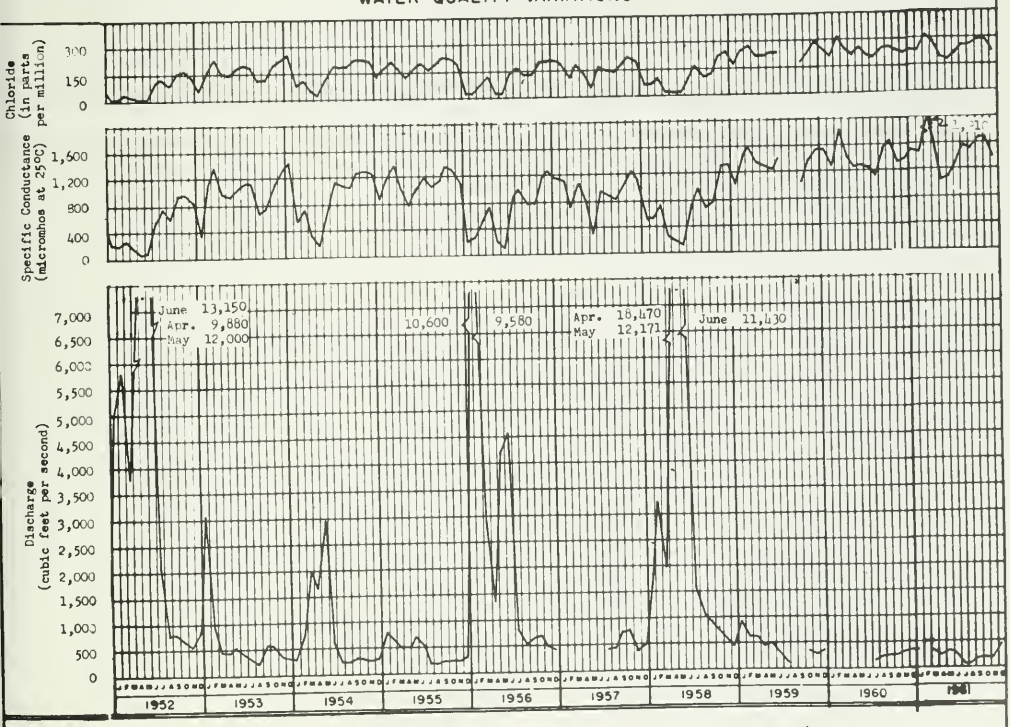
Water Quality Characteristics. Water at Station 26 varies widely both in quality and character. The water is predominantly a sodium-chloride type, however, calcium often constitutes a significant portion of the cations, and bicarbonate at times was the predominant anion. The water ranges from class 1 to class 2 for irrigation, the concentration of chloride at times exceeds the recommended limits for domestic use, and hardness ranges from soft to very hard. Irrigation returns, effluent ground water, and waste discharges have caused mineral concentrations to increase along this reach of the river.

Significant Water Quality Changes. As was the case at Hills Ferry Bridge (STA. 25b which is upstream from this station, maximum values of record for several mineral constituents were established in 1960 and 1961. Throughout this period, the water was class 2 for irrigation.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,910	91	1,910	1,080
Temperature in °F	81	45	77	45
Dissolved oxygen in parts per million	15.0	4.4	12.7	4.4
Percent saturation	174	41	151	41
pH	8.6	6.8	8.4	7.4
Mineral constituents in parts per million				
Calcium (Ca)	72	7.2	67	50
Magnesium (Mg)	47	2.1	54	30
Sodium (Na)	247	7.6	233	128
Potassium (K)	5.2	1.1	4.0	3.2
Carbonate (CO_3)	3.0	0.0	3.0	0.0
Bicarbonate (HCO_3)	266	35	266	181
Sulfate (SO_4)	180	5.8	180	100
Chloride (Cl)	318	6.0	318	175
Nitrate (NO_3)	4.4	0.8	4.2	3.0
Fluoride (F)	0.4	0.0	0.3	0.1
Boron (B)	1.6	0.0	1.1	0.3
Silica (SiO_2)	27	11	26	20
Total dissolved solids in parts per million	1,140	54	1,140	613
Percent sodium	61	36	60	44
Hardness as $CaCO_3$ in parts per million	402	25	402	249
Total				
Noncarbonate	212	0.0	205	90
Turbidity	300	0.0	120	4
Coliform in most probable number per milliliter	7,000.	1.3	230	2.1
Radioactivity in micro-micro curies per liter				
Dissolved alpha	4.07	0.00	0.31	0.25
Solid alpha	1.56	0.00	0.76	0.03
Dissolved beta	15.5	0.00	9.2	1.4
Solid beta	40.07	0.00	0.9	0.0

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER NEAR GRAYSON (STA. NO. 26)

SAN JOAQUIN RIVER AT MAZE ROAD BRIDGE (STA. 26a)

Sampling Point. Station 26a is located in Section 29, Township 3 South, Range 7 East, Mt. Diablo Base and Meridian, in Stanislaus County. Monthly grab samples were collected from the left bank, 50 feet upstream from El Solyo Ranch irrigation intake, and about 300 feet from Maze Road Bridge.

Period of Record. April 1951 through December 1961.

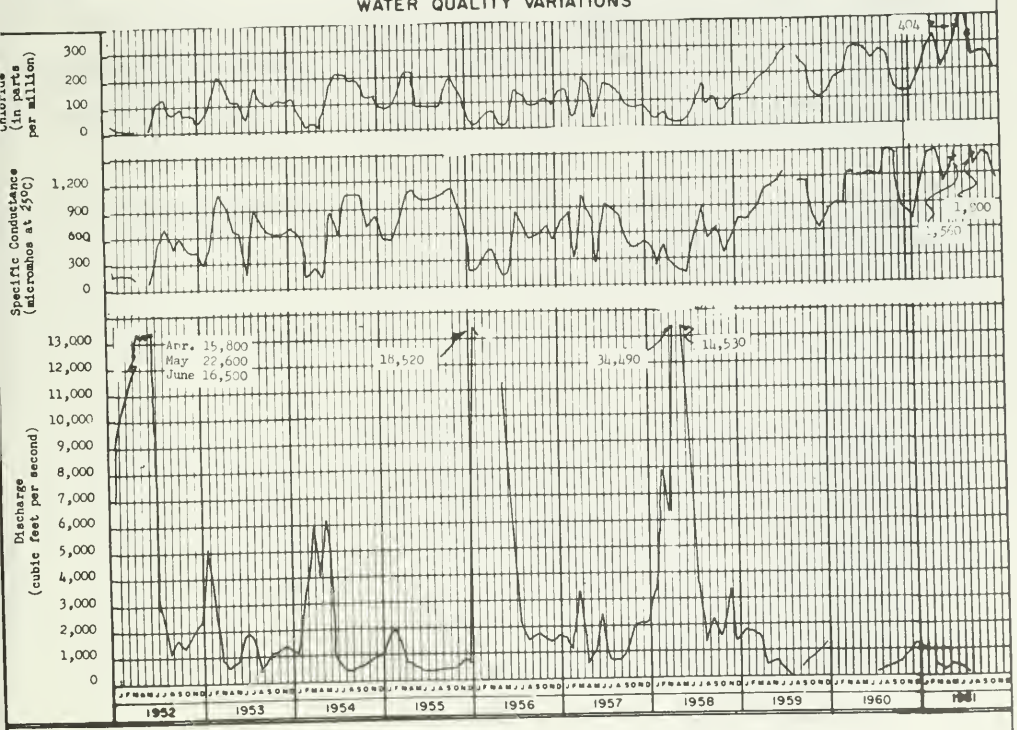
Water Quality Characteristics. Water at Maze Road Bridge is normally sodium-chloride in type, ranges from soft to very hard, and generally meets mineral standards for domestic use. Although water at this station ranges from class 1 to class 2 for irrigation, its mineral quality is somewhat better than at Station 26 near Grayson, located about 11 miles upstream. The improvement in quality reflects the influence of tributary Tuolumne River water which enters the San Joaquin River between these two stations.

Significant Water Quality Changes. Maximum values of record for a number of mineral constituents were recorded in 1961. During 9 months in 1960 and for 11 months in 1961 the water was class 2 for irrigation.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,800	97	1,100	729
Temperature in °F	81	45	79	45
Dissolved oxygen in parts per million	15.7	6.0	11.9	6.0
Percent saturation	184	55	135	55
pH	8.5	6.7	8.1	7.3
Mineral constituents in parts per million				
Calcium (Ca)	78	8.3	78	53
Magnesium (Mg)	35	2.7	35	28
Sodium (Na)	206	7.4	206	88
Potassium (K)	8.2	1.2	8.2	5.2
Carbonate (CO_3)	19	0.0	0.0	0.0
Bicarbonate (HCO_3)	224	31	224	108
Sulfate (SO_4)	116	5.3	112	88
Chloride (Cl)	404	5	404	122
Nitrate (NO_3)	5.1	0.0	4.3	1.5
Fluoride (F)	0.6	0.0	0.3	0.1
Boron (B)	0.73	0.0	.65	0.3
Silica (SiO_2)	34	9.3	30	26
Total dissolved solids in parts per million	1,005	54	1,005	406
Percent sodium	59	38	57	52
Hardness as $CaCO_3$ in parts per million				
Total	392	25	392	152
Noncarbonate	227	1	227	63
Turbidity	300	0.0	45	10
Coliform in most probable number per milliliter	7,000.	1.3	2,400.	23.
Radioactivity in micro-micro curies per liter				
Dissolved alpha	2.88	0.00	0.79	0.34
Solid alpha	1.56	0.00	0.55	0.44
Dissolved beta	12.7	0.00	5.7	4.1
Solid beta	20.6	0.00	4.4	0.0

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER AT MAZE ROAD BRIDGE (STA. NO. 26a)

SAN JOAQUIN RIVER NEAR VERNALIS (STA. 27)

Sampling Point. Station 27 is located in Section 13 of Township 3 South, Range 6 East, Mt. Diablo Base and Meridian, in San Joaquin County. Monthly grab samples were collected from the Durham Ferry highway bridge, at the center of flow, 3 miles downstream from Stanislaus River, and 3.4 miles northeast of Vernalis.

Period of Record. April 1951 through December 1961.

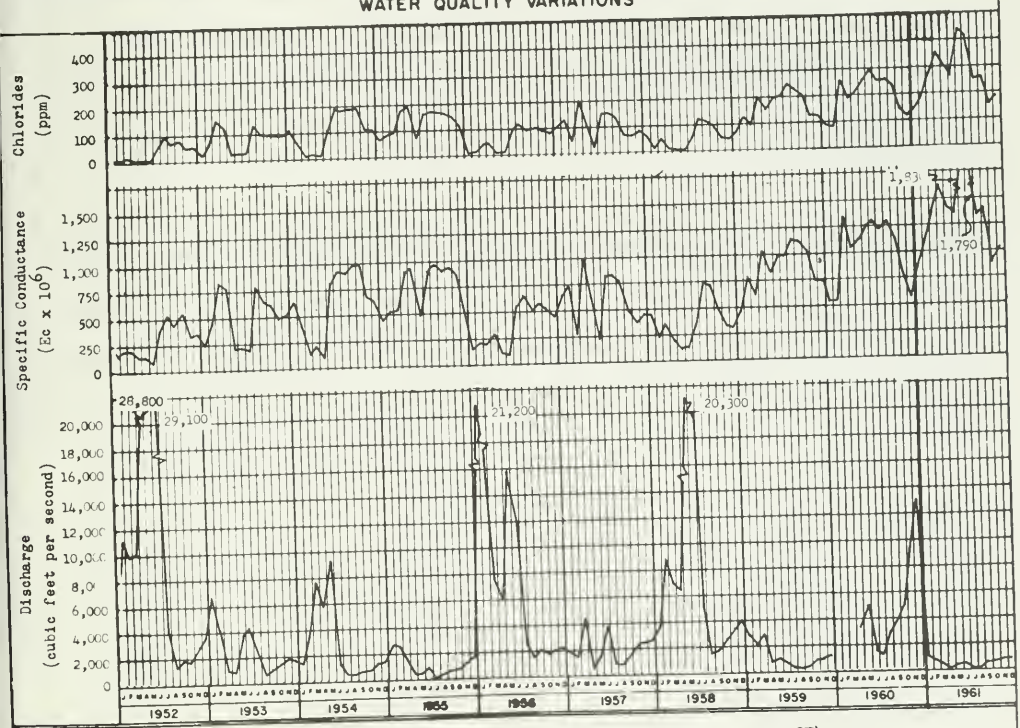
Water Quality Characteristics. The water at Station 27 generally is sodium-chloride to sodium chloride-bicarbonate in character, and usually exceeds commonly acceptable hardness limits for domestic use. Chlorides and dissolved solids occasionally exceed the recommended limiting concentration for domestic use and cause the water to be class 2 for irrigation.

Significant Water Quality Changes. Chloride concentrations exceeded class 3 for irrigation use during July and August of 1961. New maximum concentrations were observed for many mineral constituents, including total dissolved solids and chlorides, also during 1961. The lack of improvement in quality between Stations 26a and 27 has been attributed to the low flow conditions of tributary inflow from Stanislaus River.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	2,270	92	2,270	712
Temperature in °F	83	45	83	50
Dissolved oxygen in parts per million	16.2	5.4	15.4	7.7
Percent saturation	200	60	189	70
pH	8.5	6.5	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	111	8.4	111	29
Magnesium (Mg)	55	1.9	55	14
Sodium (Na)	230	8.0	230	73
Potassium (K)	8.8	0.9	6.2	2.6
Carbonate (CO_3)	12	0.0	12	0.0
Bicarbonate (HCO_3)	228	32	228	111
Sulfate (SO_4)	120	2.9	120	48
Chloride (Cl)	543	8	543	112
Nitrate (NO_3)	6.5	0.3	6.5	0.3
Fluoride (F)	0.4	0.0	0.3	0.1
Boron (B)	0.8	0.0	0.8	0.2
Silica (SiO_2)	45	10	37	18
Total dissolved solids in parts per million	1,220	52	1,220	387
Percent sodium	58	32	58	48
Hardness as $CaCO_3$ in parts per million				
Total	503	26	503	148
Noncarbonate	347	0.0	347	54
Turbidity	200	0.0	70	6
Coliform in most probable number per milliliter	24,000.	0.62	2,400.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	2.02	0.00	0.34	0.15
Solid alpha	2.10	0.00	0.76	0.31
Dissolved beta	13.02	0.00	6.5	4.3
Solid beta	14.88	0.00	1.4	0.0

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER NEAR VERNALIS (STA. NO. 27)

SALT SLOUGH AT SAN LUIS RANCH (STA. 92a)

Sampling Point. Station 92a is located in Section 7 of Township 9 South, Range 11 East, Mt. Diablo Base and Meridian, in Merced County. Monthly grab samples were collected at the center of flow, from a bridge about 8 miles north of Los Banos, at San Luis Ranch.

Period of Record. November 1958 through December 1961.

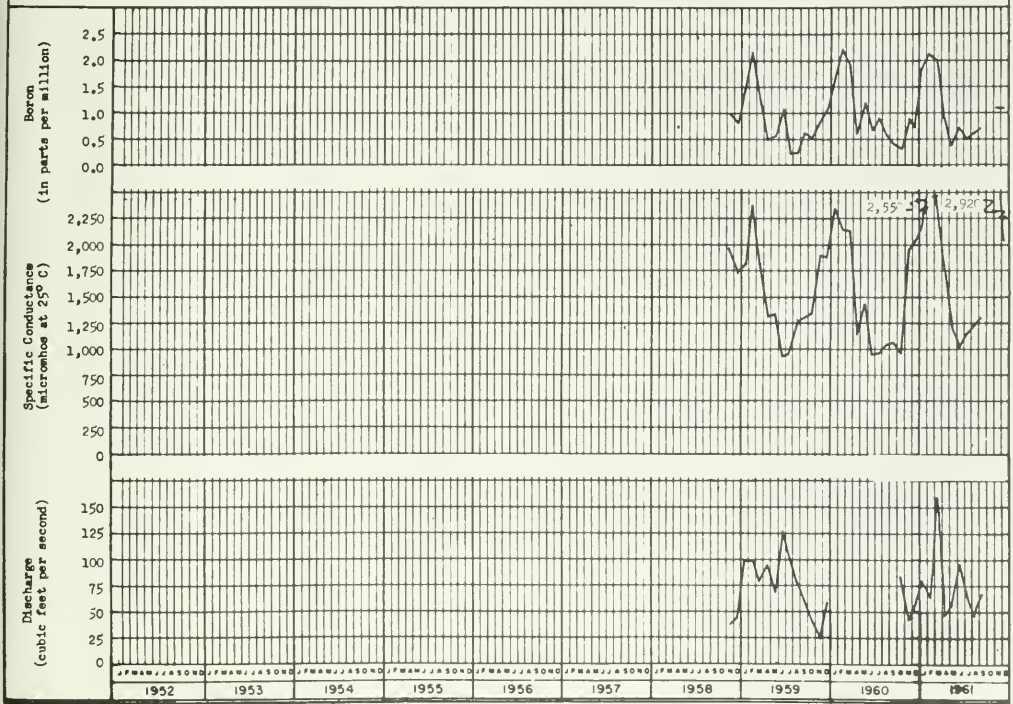
Water Quality Characteristics. Water of the slough generally is sodium-chloride in character, very hard, and is class 2, and occasionally class 3, for irrigation. Dissolved solids, chlorides, and sulfates usually exceed the recommended limits for domestic use. During winter months, storm and surface drainage and ground water accretions supplied the preponderance of flow and caused high electrical conductivity in excess of 2,000 micromhos. However, during the irrigation season, return waters (with an average electrical conductivity of 1,000 micromhos) contribute significant quantities of flow to the slough and frequently dilute the concentrations of most dissolved minerals to within the limits recommended for domestic use.

Significant Water Quality Changes. Chloride concentrations exceeded recommended limits for class 2 irrigation water and were class 3 for five months in 1961. Also during 1961, new maximums were observed for several maineral constituents including total dissolved solids, sulfates, and chlorides.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	2,920	962	2,920	1,020
Temperature in °F	83	46	83	48
Dissolved oxygen in parts per million	10.2	2.6	8.0	2.6
Percent saturation	88	28	80	28
pH	8.1	6.4	8.1	7.4
Mineral constituents in parts per million				
Calcium (Ca)	95	47	56	52
Magnesium (Mg)	55	23	32	29
Sodium (Na)	425	99	425	115
Potassium (K)	7.8	3.2	5.0	4.8
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	267	157	262	160
Sulfate (SO_4)	461	93	446	124
Chloride (Cl)	617	160	617	148
Nitrate (NO_3)	8.0	1.1	2.8	2.4
Fluoride (F)	0.5	0.1	0.5	0.3
Boron (B)	2.2	0.3	2.2	0.6
Silica (SiO_2)	27	10	25	25
Total dissolved solids in parts per million	1,755	560	1,755	620
Percent sodium	64	51	64	51
Hardness as $CaCO_3$ in parts per million				
Total	522	210	522	238
Noncarbonate	307	77	307	97
Turbidity	100	8	100	10
Coliform in most probable number per milliliter				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.49	0.09	0.49	0.37
Solid alpha	0.66	0.23	0.66	0.28
Dissolved beta	7.60	3.17	6.6	3.6
Solid beta	7.20	0.00	2.2	2.2

WATER QUALITY VARIATIONS



SALT SLOUGH AT SAN LUIS RANCH (STA. NO. 92a)

DELTA-MENDOTA CANAL NEAR MENDOTA (STA. 92)*

Sampling Point. This station is located in Section 19, Township 13 South, Range 15 East, Mt. Diablo Base and Meridian, in Fresno County. Monthly grab samples were collected from the right bank, about 1 mile upstream from the gates to Mendota Pool, and about 2 miles north of Mendota.

Period of Record. July 1952 through December 1961.

Water Quality Characteristics. Water at this station is imported from the Sacramento-San Joaquin Delta and is spilled to the San Joaquin River. It is sodium chloride-bicarbonate in character with moderate concentrations of dissolved solids, moderately hard to very hard, and normally class 1 for irrigation during the irrigation season. The water, during late summer, is frequently class 2 for irrigation because of conductivity, chloride, or percent sodium, but is generally within class 1 requirements throughout the remainder of the year.

Significant Water Quality Changes. None.

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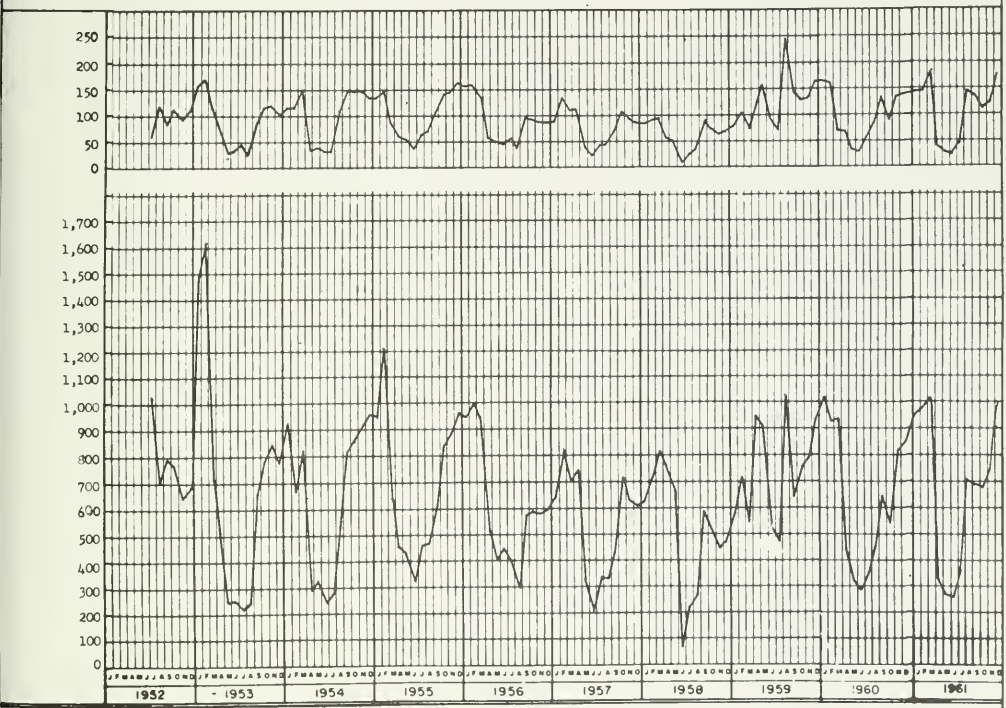
* Discussion of the quality of water at the head, or intake, end of the Delta-Mendota Canal will be found on page 348.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,630	61.5	1,060	255
Temperature in °F	81	43	78	44
Dissolved oxygen in parts per million	15.4	6.4	13.7	7.1
Percent saturation	152	77	129	73
pH	8.5	7.0	8.4	7.6
Mineral constituents in parts per million				
Calcium (Ca)	67	13	21	19
Magnesium (Mg)	35	4.1	16	8.4
Sodium (Na)	232	4.2	115	21
Potassium (K)	5.2	1.5	4.2	1.1
Carbonate (CO_3)	4	0.0	4.0	0.0
Bicarbonate (HCO_3)	249	28	224	74
Sulfate (SO_4)	154	22	39	27
Chloride (Cl)	245	1.8	178	23
Nitrate (NO_3)	2.0	0.6	0.8	0.8
Fluoride (F)	0.4	0.0	0.3	0.2
Boron (B)	0.82	0.0	0.6	0.1
Silica (SiO_2)	46	12	19	14
Total dissolved solids in parts per million	920	35	601	145
Percent sodium	67	30	61	36
Hardness as $CaCO_3$ in parts per million				
Total	311	21	252	78
Noncarbonate	186	0.0	98	16
Turbidity	180	0.0	108	11
Coliform in most probable number per milliliter	7,000.	0.045	620.	0.045
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.50	0.00	0.23	0.09
Solid alpha	1.6	0.00	0.75	0.49
Dissolved beta	22.41	0.00	17.4	0.0
Solid beta	8.1	0.00	2.9	0.0

WATER QUALITY VARIATIONS



DELTA-MENDOTA CANAL NEAR MENDOTA (STA. NO. 92)

Fresno River Basin

Fresno River basin drains a portion of the lower western slope of the Sierra Nevada in Madera County. The Fresno River rises at an elevation of about 7,000 feet and flows westerly onto the San Joaquin Valley floor. Natural runoff varies from little or no flow in later summer, to flash floods during the rainy season, and averages about 100,000 acre-feet annually.

In the river basin, above the valley floor, only 4 square miles out of 270 would be classified valley or mesa lands. Development is limited to livestock raising and recreation.

There are no significant waste discharges within the basin. A surface water sampling station is maintained on Fresno River near Daulton to monitor quality of runoff. A discussion of analytical results of samples collected at this station is presented on the next page of this report.

FRESNO RIVER NEAR DAULTON (STA. 113)

Sampling Point. The Daulton station is located in Section 3, Township 10 South, Range 19 East, Mt. Diablo Base and Meridian, in Madera County. Monthly grab samples were collected at midstream from Hensley Bridge, about 1.6 miles upstream from the USGS gaging station, and about 5.3 miles southeast of Daulton.

Period of Record. January 1958 through December 1961.

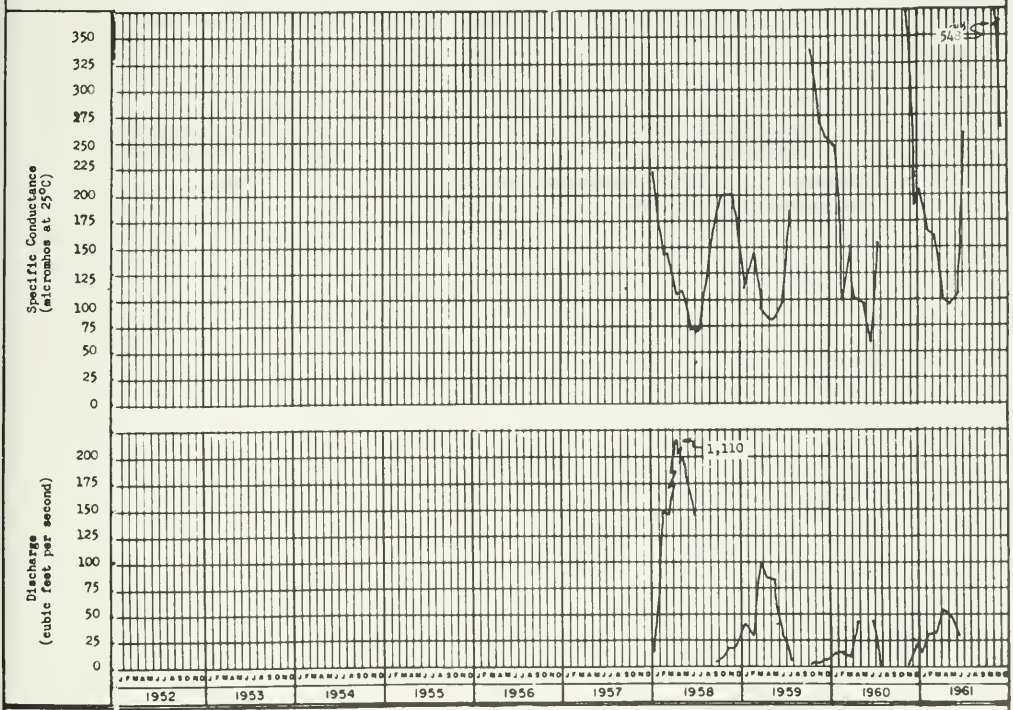
Water Quality Characteristics. Fresno River water is calcium-sodium bicarbonate-chloride in character, class 1 for irrigation, soft to moderately hard, and suitable for domestic purposes.

Significant Water Quality Changes. Although maximum values of record for specific conductance, hardness, and chlorides were established in 1961, there was no appreciable change in the overall quality characteristics at this station.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	548	69.0	548	92
Temperature in °F	95	38	95	38
Dissolved oxygen in parts per million	13.1	6.7	13.1	6.7
Percent saturation	105	73	100	93
pH	8.0	6.6	8.0	7.5
Mineral constituents in parts per million				
Calcium (Ca)	15	5.8	6.8	
Magnesium (Mg)	3.5	0.9	2.2	
Sodium (Na)	61	5.3	61	9.1
Potassium (K)	2.3	0.9	0.9	
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	73	26	72	36
Sulfate (SO_4)	5.8	0.0	0.0	0.0
Chloride (Cl)	120	4.4	120	8.7
Nitrate (NO_3)	0.5	0.0	0.1	
Fluoride (F)	0.2	0.0	0.1	
Boron (B)	0.3	0.0	0.1	0.0
Silica (SiO_2)	35	17	20	
Total dissolved solids in parts per million	377	47	377	68
Percent sodium	60	29	56	42
Hardness as $CaCO_3$ in parts per million				
Total	106	18	106.	26
Noncarbonate	47	0.0	47	0.0
Turbidity	100	0.8	35	0
Coliform in most probable number per milliliter	7,000.	0.23	62.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.70	0.00	0.33	
Solid alpha	0.83	0.00	0.83	
Dissolved beta	9.49	0.20	2.8	
Solid beta	22.4	6.16	22.4	

WATER QUALITY VARIATIONS



FRESNO RIVER NEAR DAULTON (STA. NO. 113)

Chowchilla River and Bear Creek Unit

Chowchilla River drains about 240 square miles on the lower slopes of the Sierra Nevada in Madera and Mariposa Counties. Bear Creek drains foothills in western Merced and eastern Mariposa County. Chowchilla River basin has a mean annual runoff of about 90,000 acre-feet. Mean annual runoff from Bear Creek basin is not available.

Topography in the two basins is mostly rolling foothills. Chowchilla River headwaters at about 6,000 feet is fairly well forested terrain, ground covering changes to range grass and scattered scrub trees and brush in the foothills. Livestock raising is the only significant use made of the foothill area in the unit. Only minor quantities of waste enter these streams and there are no discernible water quality impairment problems in the unit.

The following tabulation presents the name of stations maintained to monitor quality of surface water in this unit and the page on which each is discussed:

Monitoring Station	Page Number of Station Discussion
Chowchilla River at Buchanan Dam Site	294
Bear Creek at Merced	296

CHOWCHILLA RIVER AT BUCHANAN DAM SITE (STA. 114)

Sampling Point. Station 114 is located in Section 22, Township 8 South, Range 18 East, Mt. Diablo Base and Meridian, in Madera County. Monthly grab samples were collected from the left bank, at a USGS gage located about 4.3 miles west of Raymond.

Period of Record. January 1958 through December 1961.

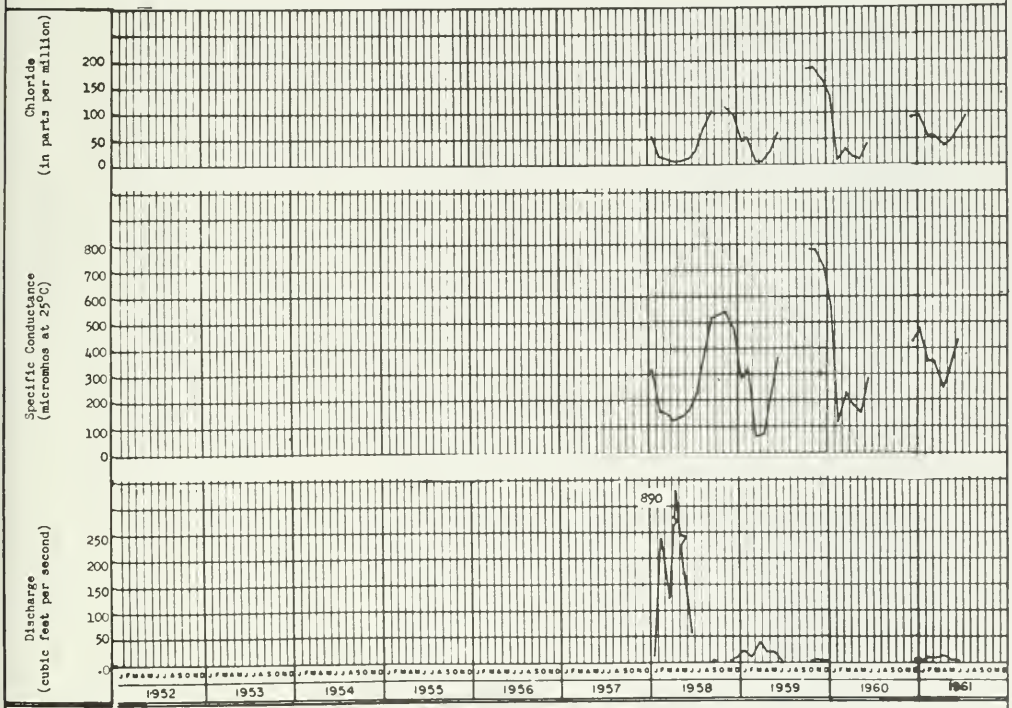
Water Quality Characteristics. Water in the stream is a mixed calcium-sodium bicarbonate type during most of the late winter and early spring months. The stream usually is dry through the summer. When winter flow resumes, the water is a mixed calcium-sodium bicarbonate-chloride type. The water normally is class 1 for irrigation, and occasionally class 2 due to chloride concentrations. Water in Chowchilla River ranges from soft to very hard.

Significant Water Quality Changes. Runoff at this station was extremely small during 1960 and 1961. However, this fact apparently had small effect on the stream's quality since no new maximums were recorded.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	783	68.2	609	254
Temperature in °F	91	35	91	38
Dissolved oxygen in parts per million	13.3	7.2	13.0	7.2
Percent saturation	118	86	101	97
pH	8.4	7.1	8.2	7.9
Mineral constituents in parts per million				
Calcium (Ca)	28	6.4	25	
Magnesium (Mg)	11	1.5	4.5	
Sodium (Na)	81	5.2	5	23
Potassium (K)	3.9	0.8	2.4	
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	132	27	102	90
Sulfate (SO_4)	12	1.0	3.0	
Chloride (Cl)	190	6.0	133	36
Nitrate (NO_3)	0.9	0.0	0.0	
Fluoride (F)	0.1	0.0	0.1	
Boron (B)	0.21	0.0	0.1	0.0
Silica (SiO_2)	41	12	24	
Total dissolved solids in parts per million	481	50	375	156
Percent sodium	59	30	45	39
Hardness as $CaCO_3$ in parts per million				
Total	202	22	154	73
Noncarbonate	104	0.0	80	0.0
Turbidity	700	0.0	25	0
Coliform in most probable number per milliliter	7,000.	0.23	62.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.40	0.17	0.33	
Solid alpha	0.64	0.17	0.17	
Dissolved beta	8.17	3.05	2.7	
Solid beta	11.55	1.00	11.1	

WATER QUALITY VARIATIONS



CHOWCHILLA RIVER AT BUCHANAN DAM SITE (STA. NO. 114)

BEAR CREEK AT MERCED (STA. 111a)

Sampling Point. The station is located in Section 24, Township 7 South, Range 13 East, Mt. Diablo Base and Meridian, in Merced County. Monthly grab samples were collected from the Highway 99 bridge at the north end of Merced.

Period of Record. October 1958 through December 1961.

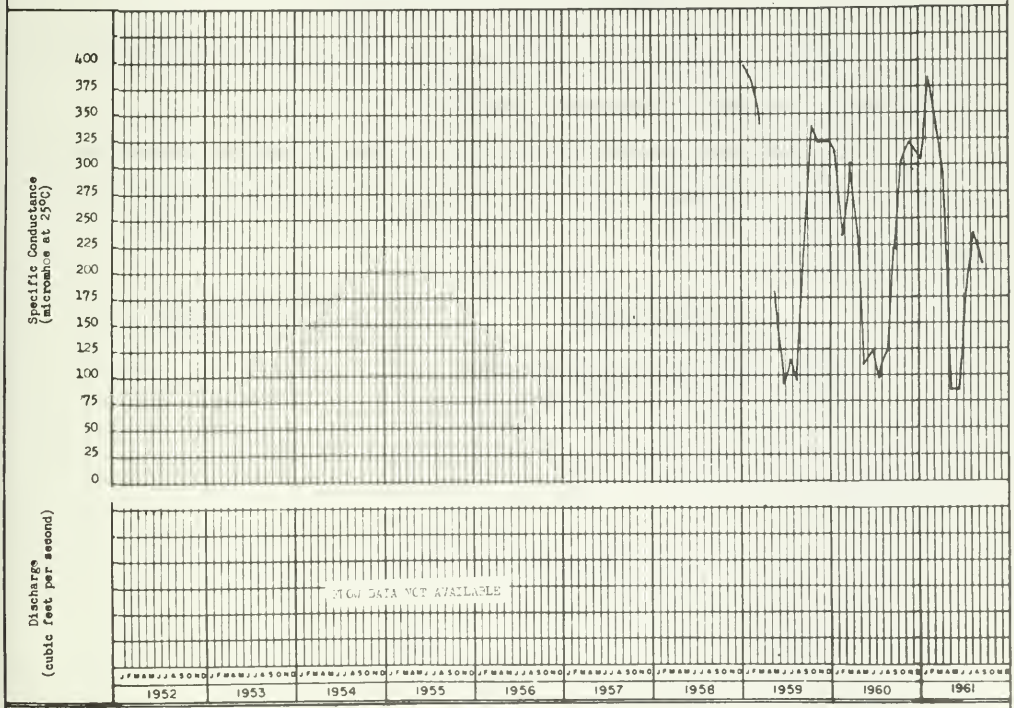
Water Quality Characteristics. The water is a mixed calcium-magnesium bicarbonate type, low in concentrations of dissolved solids, and of excellent mineral quality for most beneficial uses. However, hardness ranges from soft to hard, limiting its use for domestic and industrial purposes.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	389	85	384	85
Temperature in °F	82	40	82	40
Dissolved oxygen in parts per million	15.1	6.7	15.1	7.7
Percent saturation	135	77	116	77
pH	8.3	6.9	8.3	7.3
Mineral constituents in parts per million				
Calcium (Ca)	34	8.8	18	6.4
Magnesium (Mg)	20	2.7	7.5	4.9
Sodium (Na)	25	3.3	25	3.3
Potassium (K)	2.6	0.97	1.4	0.9
Carbonate (CO_3)	6	0.0	6	0.0
Bicarbonate (HCO_3)	209	40	209	41
Sulfate (SO_4)	29	4.0	8.0	4.0
Chloride (Cl)	16	0.4	8.5	1.2
Nitrate (NO_3)	2.2	0.0	1.3	0.2
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.1	0.0	0.1	0.0
Silica (SiO_2)	31	13	31	13
Total dissolved solids in parts per million	246	56	246	56
Percent sodium	27	15	27	15
Hardness as $CaCO_3$ in parts per million	165	33	139	42
Total	18	0.0	18	0.0
Noncarbonate				
Turbidity	100	3	100	4
Coliform in most probable number per milliliter				
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.20	0.00	0.00	
Solid alpha	0.53	0.18	0.53	
Dissolved beta	12.36	0.40	2.1	
Solid beta	16.3	0.56	16.3	

WATER QUALITY VARIATIONS



BEAR CREEK AT MERCED (STA. NO. 111a)

Merced River Basin

Merced River drains a watershed area of about 1,000 square miles in Mariposa and Merced Counties. The river originates at an elevation of 11,000 feet in the Sierra Nevada and drops to an elevation of about 400 feet as it flows out of the foothills into San Joaquin Valley. From its headwaters, the river flows almost due westward 135 miles to its junction with the San Joaquin River. Mean annual runoff from the basin is estimated to be slightly in excess of 1,000,000 acre-feet. Snowmelt sustains flow in Merced River throughout most of the summer.

Terrain in the basin is very rugged at the headwaters, and steep canyon walls comprise a good portion of the watershed along the river. Yosemite Valley is the major attraction in this basin and development is primarily based on the tourist trade attracted by the scenic and geologic wonders of the valley. Lumbering, mining, livestock raising, and providing recreational facilities comprise the balance of significant economic pursuits in the basin.

Waste discharges entering Merced River system are insignificant in volume and do not create impairment problems.

The following tabulation presents the name of stations maintained to monitor quality of surface water in this basin and indicates the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Merced River below Exchequer Dam	300
Merced River near Stevinson	302

MERCED RIVER BELOW EXCHEQUER DAM (STA. 32a)

Sampling Point. Exchequer Dam station is located in Section 14, Township 4 South, Range 15 East, Mt. Diablo Base and Meridian, in Mariposa County. Monthly grab samples were collected from the right bank, at the USGS gage house, 0.5 mile downstream from Exchequer Dam and 5 miles northeast of Merced Falls.

Period of Record. April 1959 through December 1961.

Water Quality Characteristics. The water is calcium-bicarbonate in character, soft to moderately hard, and of excellent mineral quality for nearly all beneficial uses. The quality of water at Station 32a reflects the amount of runoff in the stream; in a dry year, conductivity ranges from 25 to 240 micromhos, and in a wet year, conductivity ranges from 20 to 110 micromhos.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	242	20.1	174	26
Temperature in °F	78	44	76	44
Dissolved oxygen in parts per million	13.1	3.8	12.3	7.8
Percent saturation	122	41.5	117	91
pH	8.1	6.5	8.1	7.1
Mineral constituents in parts per million				
Calcium (Ca)	29	2.4	12	3.0
Magnesium (Mg)	7.2	0.1	2.4	0.5
Sodium (Na)	21	0.9	4.6	1.7
Potassium (K)	1.9	0.2	0.7	0.7
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	127	9	84	13
Sulfate (SO_4)	8.1	0.0	3.0	2.0
Chloride (Cl)	14	0.0	8.2	0.8
Nitrate (NO_3)	2.9	0.0	0.8	0.1
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.73	0.0	0.1	0.0
Silica (SiO_2)	16	3.7	9.3	7.1
Total dissolved solids in parts per million	158	13	114	28
Percent sodium	37	10	27	9
Hardness as $CaCO_3$ in parts per million				
Total	91	8	74	10
Noncarbonate	19	0.0	19	0.0
Turbidity	400	0.0	40	1
Coliform in most probable number per milliliter	7,000.	0.045	2,400.	0.045
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.54	0.00	0.20	0.08
Solid alpha	1.61	0.00	0.53	0.30
Dissolved beta	18.3	0.00	3.7	3.4
Solid beta	8.4	0.00	8.4	0.0

WATER QUALITY VARIATIONS

MERCED RIVER BELOW EXCHEQUER DAM (STA. NO. 32a)

MERCED RIVER NEAR STEVINSON (STA. 32)

Sampling Point. Station 32 is located in Section 36, Township 6 South, Range 9 East, Mt. Diablo Base and Meridian, in Merced County. Monthly grab samples were collected from the right bank, 100 feet upstream from a USGS gage, about 6 miles northwest of Stevinson.

Period of Record. April 1951 through December 1961.

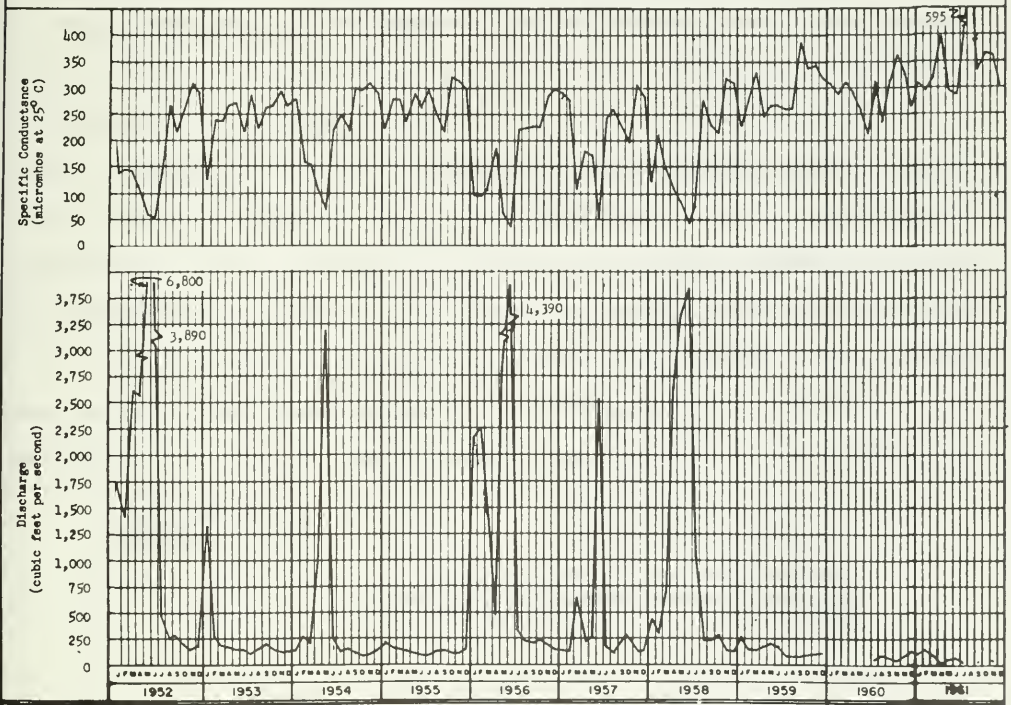
Water Quality Characteristics. Water in the river near Stevinson is a mixed calcium-sodium bicarbonate type, slightly hard to hard, and of excellent mineral quality for nearly all beneficial uses. Comparison of mineral quality of water at Station 32 with that at Merced River below Exchequer Dam (STA. 32a), about 50 miles upstream, reveals a large increase (about 200 micromhos) in dissolved solids However, quality of water is still excellent at both stations.

Significant Water Quality Changes. Maximums of record for specific conductance, chloride, and hardness were recorded in 1961.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	595	33.6	595	286
Temperature in °F	83	45	78	51
Dissolved oxygen in parts per million	12.8	7.0	12.2	7.1
Percent saturation	136	78	136	82
pH	8.4	6.6	8.4	7.5
Mineral constituents in parts per million				
Calcium (Ca)	28	4.8	23	21
Magnesium (Mg)	11	0.3	8.9	6.9
Sodium (Na)	66	2.0	66	28
Potassium (K)	3.7	0.5	2.0	1.7
Carbonate (CO_3)	14	0.0	4.0	0.0
Bicarbonate (HCO_3)	205	18	205	129
Sulfate (SO_4)	22	3.3	15	12
Chloride (Cl)	80	0.0	80	14
Nitrate (NO_3)	4.6	0.0	3.4	2.3
Fluoride (F)	0.4	0.0	0.1	0.1
Boron (B)	0.31	0.0	0.1	0.0
Silica (SiO_2)	49	7.5	30	26
Total dissolved solids in parts per million	383	21.6	383	184
Percent sodium	55	14	50	39
Hardness as $CaCO_3$ in parts per million				
Total	149	13	149	81
Noncarbonate	18	0.0	0.0	0.0
Turbidity	60	0.0	25	2
Coliform in most probable number per milliliter	7,000.	0.046	7,000.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.55	0.00	0.69	0.48
Solid alpha	0.76	0.00	0.40	0.06
Dissolved beta	13.50	0.00	9.0	3.8
Solid beta	19.74	0.00	2.2	0.0

WATER QUALITY VARIATIONS



MERCED RIVER NEAR STEVINSON (STA. NO. 32)

Tuolumne River Basin

Tuolumne River basin encompasses approximately 1,500 square miles on the western slopes of the Sierra Nevada in the east-central portion of the Central Valley Region. Headwatering from glacial lakes high in the mountains, the stream flows southwesterly for about 150 miles to its junction with the San Joaquin River. Average annual discharge of Tuolumne River basin is estimated to be somewhat less than 2,000,000 acre-feet.

Above the San Joaquin Valley floor, the basin is a mountainous, foothill area. The upper portion drains a few meadows and plateaus, but the river soon drops into a steep canyon and flows through a gorge for a distance of about 80 miles. Elevation varies from 300 feet at the foothill line to over 13,000 feet at the crest of the Sierra Nevada.

Economic developments in the basin are typical of mountainous areas and include resort areas, lumbering, mining, livestock raising, and recreational facilities.

Numerous wastes from individual domestic, lumber mill, and resort developments discharge into the Tuolumne watershed. These waste discharges are minor in quantity and have not caused significant impairment problems. However, overflow from abandoned and partially used gas wells along the river from Waterford to Modesto are discharging saline waters into the river causing higher chloride concentrations not characteristic of water from the upper watershed.

The following tabulation lists the stations maintained to monitor quality of surface waters in this basin and indicates the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Tuolumne River below Don Pedro Dam	306
Tuolumne River at Hickman-Waterford Bridge	308
Tuolumne River at Tuolumne City	310

TUOLUMNE RIVER BELOW DON PEDRO DAM (STA. 31a)

Sampling Point. Don Pedro Dam station is located in Section 3, Township 3 South, Range 14 East, Mt. Diablo Base and Meridian, in Tuolumne County. Monthly grab samples were collected from the left bank, about one-quarter mile downstream from the dam, and approximately 5 miles upstream from La Grange.

Period of Record. April 1951 through December 1961.

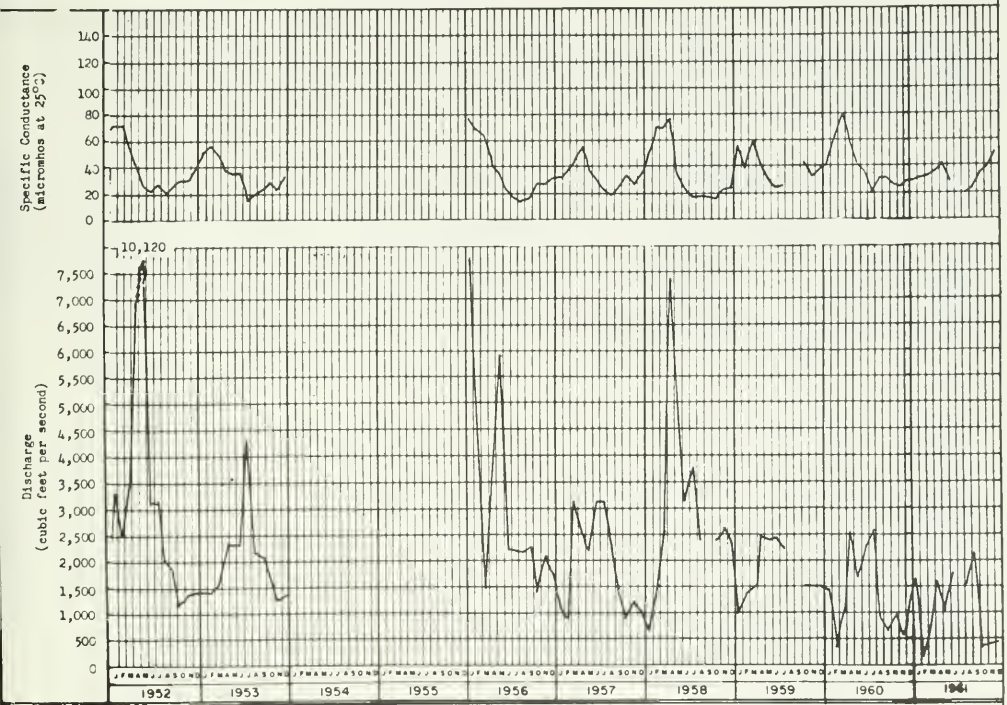
Water Quality Characteristics. Water at this station is calcium-bicarbonate in character, excellent in mineral quality, soft, and suitable for all beneficial uses.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	154	13.6	51	20
Temperature in °F	72	44	72	47
Dissolved oxygen in parts per million	13.6	4.4	10.3	5.7
Percent saturation	133	49	89	64
pH	8.8	6.0	7.5	6.7
Mineral constituents in parts per million				
Calcium (Ca)	7.1	0.8	3.8	2.5
Magnesium (Mg)	2.7	0.1	1.5	0.5
Sodium (Na)	5.1	0.7	2.3	1.2
Potassium (K)	1.0	0.3	0.7	0.4
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	40	8	24	12
Sulfate (SO_4)	2.9	0.0	1.0	0.2
Chloride (Cl)	10	0.0	2.1	0.0
Nitrate (NO_3)	0.8	0.0	0.5	0.4
Fluoride (F)	0.2	0.0	0.1	0.0
Boron (B)	0.17	0.0	0.1	0.0
Silica (SiO_2)	22	4.0	7.2	4.8
Total dissolved solids in parts per million	117	13	39	15
Percent sodium	44	12	32	12
Hardness as $CaCO_3$ in parts per million				
Total	39	4	20	7
Noncarbonate	13	0.0	7	0.0
Turbidity	70	0.0	10	1
Coliform in most probable number per milliliter	7,000.	0.045	2,400.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	2.25	0.00	0.24	0.12
Solid alpha	1.07	0.00	0.40	0.0
Dissolved beta	9.57	0.00	3.8	0.0
Solid beta	7.01	0.00	4.1	0.0

WATER QUALITY VARIATIONS



TUOLUMNE RIVER BELOW DON PEDRO DAM (STA. NO. 31a)

TUOLUMNE RIVER AT HICKMAN-WATERFORD BRIDGE (STA. 30)

Sampling Point. The station is located within Section 34, Township 3 South, Range 11 East, Mt. Diablo Base and Meridian, in Stanislaus County. Monthly grab samples were taken from Hickman-Waterford Bridge about one-half mile south of Waterford.

Period of Record. April 1951 through December 1961.

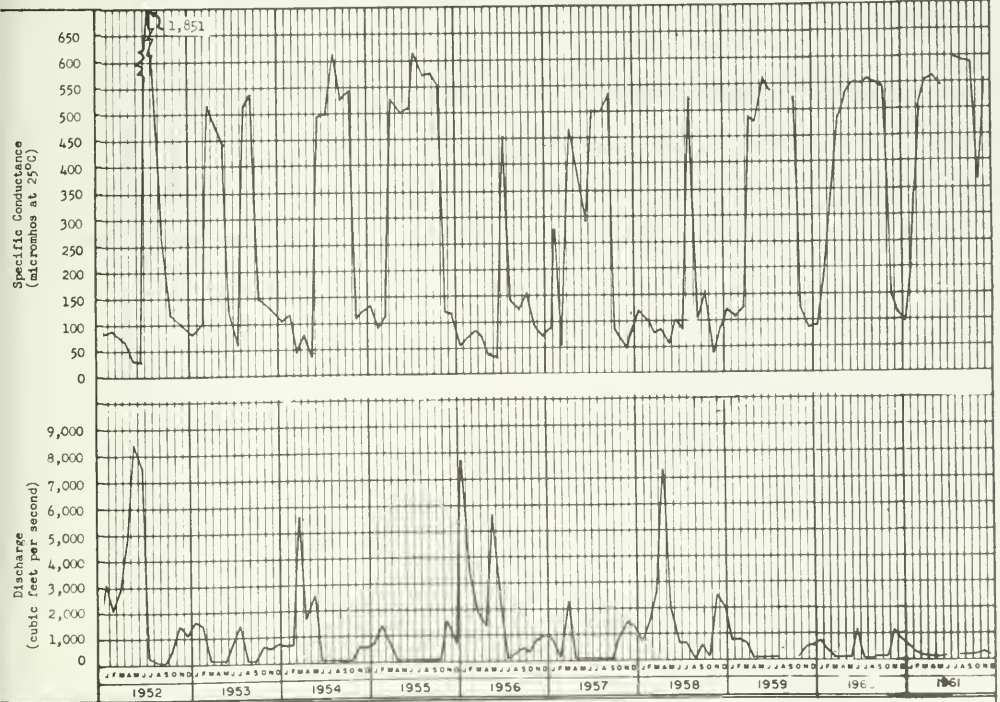
Water Quality Characteristics. The water is a mixed calcium-sodium-magnesium bicarbonate type during most of the year. During months when the flow is low due to upstream diversion, the river becomes sodium-chloride in character. Tuolumne River is class 1 for irrigation, soft to hard, and suitable for nearly all beneficial uses. Overflow from abandoned and partially used gas wells discharge saline waters into the river along the reach upstream from the station. Degradation from the saline well water was most apparent during low flow periods when less dilution water was available. Station 30 is located approximately 25 miles downstream from Don Pedro Dam (STA. 31a). Comparison of quality at these two stations shows a considerable increase in mineral concentrations at the downstream station.

Significant Water Quality Changes. The trend toward increased mineral concentrations in the Tuolumne River at this station, which was started in 1959, continued during 1960 and 1961. However, in spite of reduced flows which brought about these increased concentrations, no new maximums were recorded.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	613	32	593	98.7
Temperature in °F	81	45	77	48
Dissolved oxygen in parts per million	13.5	5.7	10.9	7.7
Percent saturation	136	70	115	75
pH	8.4	6.6	8.2	7.4
Mineral constituents in parts per million				
Calcium (Ca)	55	2.8	33	29
Magnesium (Mg)	17	1.2	13	12
Sodium (Na)	117	1.6	64	7.7
Potassium (K)	10	0.5	6.1	5.6
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	164	12	131	29
Sulfate (SO_4)	26	0.0	4.0	1.6
Chloride (Cl)	206	0.0	124	13
Nitrate (NO_3)	4.6	0.0	0.6	0.3
Fluoride (F)	0.3	0.0	0.2	0.1
Boron (B)	0.18	0.0	0.1	0.0
Silica (SiO_2)	55	6.8	50	49
Total dissolved solids in parts per million	355	19	346	58
Percent sodium	54	16	51	38
Hardness as $CaCO_3$ in parts per million				
Total	206	11	146	27
Noncarbonate	72	0.0	44	3
Turbidity	45	0.0	15	1
Coliform in most probable number per milliliter	7,000.	0.045	7,000.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.08	0.00	0.12	0.08
Solid alpha	0.83	0.00	0.41	0.0
Dissolved beta	12.43	0.00	5.8	4.6
Solid beta	8.57	0.00	0.0	0.0

WATER QUALITY VARIATIONS



TUOLUMNE RIVER AT HICKMAN-WATERFORD BRIDGE (STA. NO. 30)

TUOLUMNE RIVER AT TUOLUMNE CITY (STA. 31)

Sampling Point. Tuolumne City station is located in Section 7, Township 4 South, Range 8 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from Shiloh Road bridge, about 8 miles west of Modesto, Stanislaus County.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Antecedent data show the water has been predominantly a sodium-calcium chloride type changing to sodium-chloride character during summer months. Tuolumne River water becomes class 2 for irrigation occasionally due to excessive chloride concentrations. Hardness ranges from slightly hard to very hard limiting its beneficial uses. The City of Modesto discharges treated sewage into the river approximately eight miles upstream. No significant change in mineral quality has been noted at this station that can be attributed to the Modesto waste discharges.

Significant Water Quality Changes. During 1961, the mineral concentrations observed at the station were the highest of record. During seven months in 1960, and for nine months in 1961, the water was class 2 for irrigation primarily due to chloride concentrations in excess of 175 ppm, the upper limit for class 1 water.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1270	74.5	1270	328
Temperature in °F	84	45	79	45
Dissolved oxygen in parts per million	18.4	2.2	9.8	2.2
Percent saturation	224	29	96	23
pH	8.9	6.3	8.3	7.1
Mineral constituents in parts per million				
Calcium (Ca)	73	3.6	73	53
Magnesium (Mg)	19	1.4	19	13
Sodium (Na)	145	3.8	145	32
Potassium (K)	10	0.7	8.0	6.2
Carbonate (CO_3)	3.0	0.0	1.0	0.0
Bicarbonate (HCO_3)	186	20	186	49
Sulfate (SO_4)	26	0.0	13	7.2
Chloride (Cl)	298	6.9	298	65
Nitrate (NO_3)	4.6	0.0	4.2	2.0
Fluoride (F)	0.4	0.0	0.2	0.0
Boron (B)	0.35	0.0	0.23	0.0
Silica (SiO_2)	57	6.5	43	40
Total dissolved solids in parts per million	686	34.2	686	188
Percent sodium	56	25	55	49
Hardness as $CaCO_3$ in parts per million				
Total	259	14	259	68
Noncarbonate	113	0.0	113	28
Turbidity	45	0.0	15	3
Coliform in most probable number per milliliter	7,000.	0.18	7,000.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.23	0.00	0.50	0.16
Solid alpha	1.10	0.00	0.41	0.03
Dissolved beta	24.3	0.00	8.7	7.2
Solid beta	6.1	0.00	0.6	0.0

WATER QUALITY VARIATIONS

TUOLUMNE RIVER AT TUOLUMNE CITY (STA. NO. 31)

Stanislaus River Basin

Stanislaus River drains a narrow basin on the western slope of the Sierra Nevada in the northeastern part of San Joaquin River subregion. About 1,000 square miles of mountains and foothills are enclosed within the boundaries of the watershed. The drainage basin slopes westward from an elevation of over 10,000 feet at the crest of the Sierra Nevada to about 20 feet at its confluence with the San Joaquin River. Mean annual runoff of the Stanislaus River is about 1,200,000 acre-feet.

Extremely rugged topography, which includes bare granite peaks and steep canyons, limits development along the upper reaches of the basin. At lower elevations, the ridges and valleys are covered with timber which have promoted lumbering operations while the foothills provide grazing land suitable for livestock raising. Other commercial pursuits are generally associated with recreation, mining activities, or catering to the tourist trade attracted by the scenery and colorful history of this area.

Waste discharges enter the drainage basin in only small volumes. No serious impairment of mineral quality has resulted from these small waste discharges.

The following tabulation presents the name of stations maintained to monitor quality of surface water in this basin and lists the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Stanislaus River below Tulloch Dam	314
Stanislaus River near Mouth	316

STANISLAUS RIVER BELOW TULLOCH DAM (STA. 29a)

Sampling Point. The Tulloch Dam station is located within Section 1, Township 1 South, Range 12 East, Mt. Diablo Base and Meridian, in Tuolumne County. The monthly water samples were collected downstream from Tulloch Dam, and approximately 6 miles northeast of Knights Ferry.

Period of Record. July 1956 through December 1961.

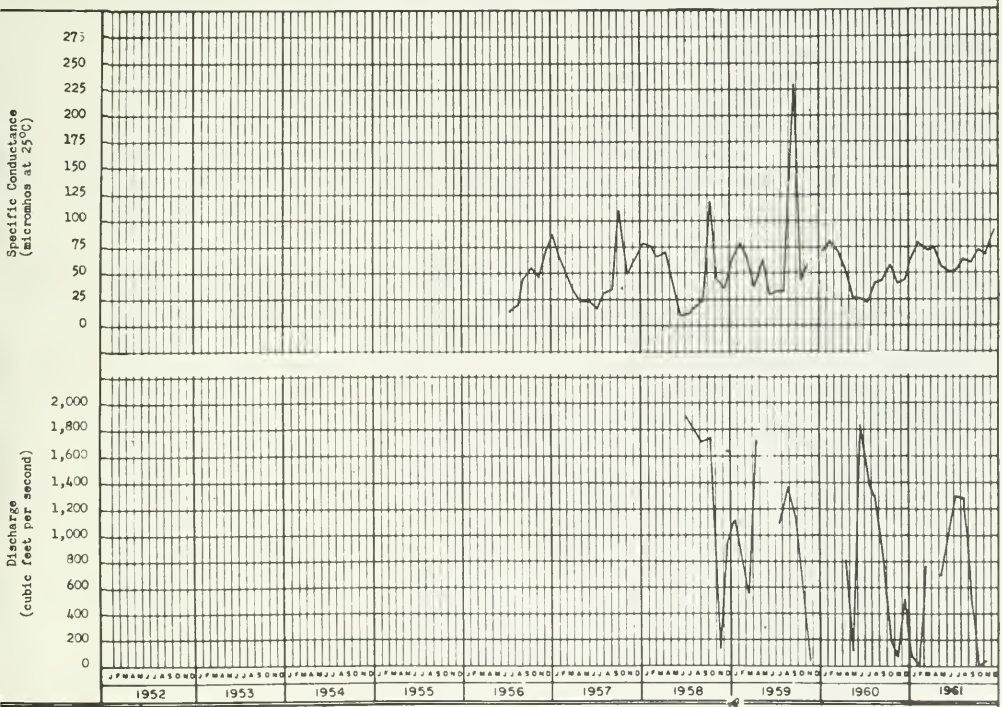
Water Quality Characteristics. Analyses show the water generally to be calcium-magnesium bicarbonate in character, soft, excellent in mineral quality, and suitable for all beneficial uses. Quality of water at this station does not vary significantly, even with wide fluctuations in flow, indicating that regulation by upstream water resources developments apparently stabilizes mineral concentrations.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	255	35.1	90	50
Temperature in °F	75	40	75	49
Dissolved oxygen in parts per million	13.1	5.3	11.9	5.3
Percent saturation	119	53	113	53
pH	8.0	6.8	7.7	7.3
Mineral constituents in parts per million				
Calcium (Ca)	25	4.9	5.6	4.9
Magnesium (Mg)	9.4	0.5	2.8	2.1
Sodium (Na)	15	1.3	3.4	1.3
Potassium (K)	2.4	0.3	0.7	0.3
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	143	17	45	28
Sulfate (SO_4)	7.0	0.0	2.0	0.0
Chloride (Cl)	7.0	0.0	2.5	0.0
Nitrate (NO_3)	1.3	0.0	0.3	0.1
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.3	0.0	0.1	0.0
Silica (SiO_2)	38	10	17	8.9
Total dissolved solids in parts per million	175	25	63	35
Percent sodium	24	4	19	8
Hardness as $CaCO_3$ in parts per million	101	14	41	20
Total	19	0.0	6	0.0
Noncarbonate				
Turbidity	80	0.0	20	0.9
Coliform in most probable number per milliliter	7,000.	0.045	130.	0.046
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.41	0.00	0.08	0.0
Solid alpha	0.94	0.00	0.16	0.0
Dissolved beta	5.72	0.00	2.1	0.7
Solid beta	3.08	0.00	2.7	0.0

WATER QUALITY VARIATIONS



STANISLAUS RIVER BELOW TULLOCH DAM (STA. NO. 29a)

STANISLAUS RIVER NEAR MOUTH (STA. 29)

Sampling Point. Station 29 is located in Section 17, Township 3 South, Range 7 East, Mt. Diablo Base and Meridian, in San Joaquin County. Monthly grab samples were collected from the right bank, at the foot of Department of Water Resources gage house, about 1 mile above the junction with San Joaquin River, and about 9 miles south of Manteca.

Period of Record. April 1951 through December 1961.

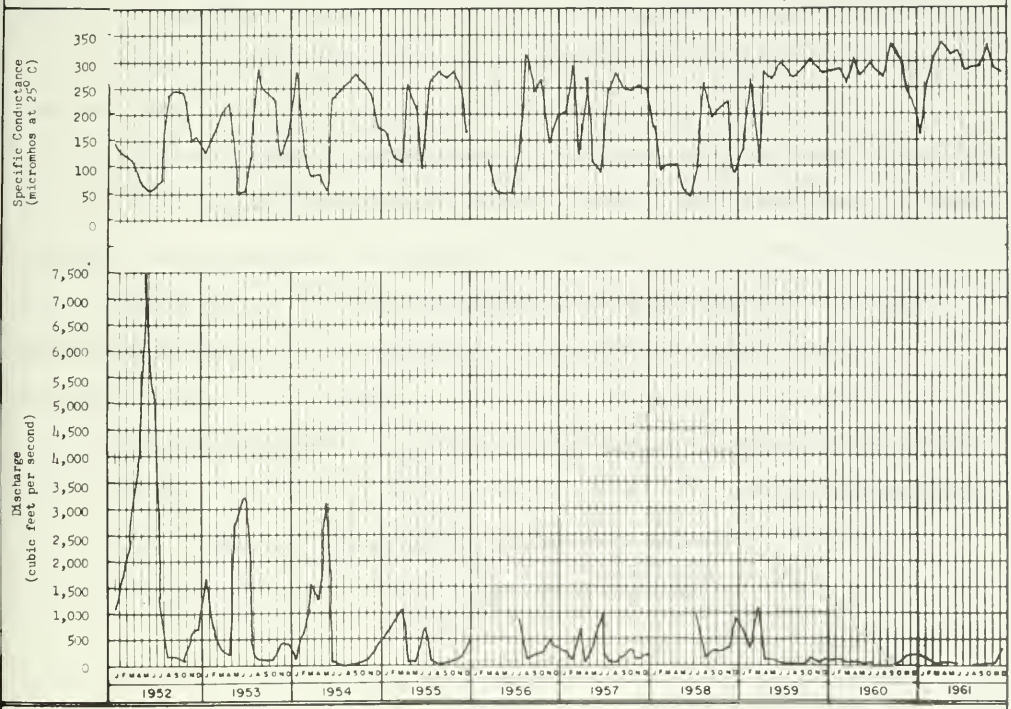
Water Quality Characteristics. The water is calcium-magnesium bicarbonate in type, and excellent in mineral quality for nearly all beneficial uses. Hardness, however, ranges from soft to hard limiting its use for domestic purposes. Mineral concentrations in water at Stanislaus River mouth station are about 50 percent higher (about 40 to 250 micromhos higher) than those found at the upstream station at Tulloch Dam. This mineral pickup has been attributed to tributary drainage and waste discharges.

Significant Water Quality Changes. As at most other stations in the San Joaquin Valley, the Stanislaus River at this station experienced a rising trend toward increased mineral concentrations which began in 1959. Maximums of record for specific conductance and chloride concentration were established in 1961. However, these increases and new maximums were of relatively small consequence for the stream's quality remained excellent for all beneficial uses excepting those limited by hardness.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	335	47.3	335	115
Temperature in °F	87	43	87	50
Dissolved oxygen in parts per million	13.0	6.4	11.4	6.8
Percent saturation	136	61	136	74
pH	8.3	6.8	8.1	7.1
Mineral constituents in parts per million				
Calcium (Ca)	31	5.5	31	29
Magnesium (Mg)	14	1.2	14	12
Sodium (Na)	22	1.5	21	7.1
Potassium (K)	3.4	0.7	2.1	1.5
Carbonate (CO_3)	5	0.0	0.0	0.0
Bicarbonate (HCO_3)	204	24	204	82
Sulfate (SO_4)	11	0.0	10	7.0
Chloride (Cl)	24	0.0	24	2.8
Nitrate (NO_3)	2.6	0.0	0.6	0.4
Fluoride (F)	0.3	0.0	0.3	0.1
Boron (B)	0.37	0.0	0.1	0.0
Silica (SiO_2)	37	9.3	34	29
Total dissolved solids in parts per million	226	32	226	105
Percent sodium	28	13	25	18
Hardness as $CaCO_3$ in parts per million				
Total	197	21	148	65
Noncarbonate	8	0.0	0.0	0.0
Turbidity	100	0.0	50	3
Coliform in most probable number per milliliter	7,000.	0.13	7,000.	5.
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.67	0.00	0.24	0.0
Solid alpha	1.22	0.00	0.41	0.9
Dissolved beta	10.01	0.00	1.3	0.7
Solid beta	11.52	0.00	1.2	0.0

WATER QUALITY VARIATIONS



STANISLAUS RIVER NEAR MOUTH (STA. NO. 29)

Sacramento-San Joaquin Delta Drainage (5c)

The Sacramento-San Joaquin Delta Drainage comprises the central portion of the great Central Valley Basin. The drainage area extends north to the City of Sacramento, south to the vicinity of Vernalis, east to the crest of the Sierra Nevada Range, and west to Carquinez Straits. The watersheds of the Calaveras, Cosumnes, and Mokelumne Rivers are included in the area. Major streams entering the Sacramento-San Joaquin Delta include the Sacramento River from the north, the San Joaquin River from the south, and the Calaveras, Cosumnes, and Mokelumne Rivers from the east. The Sacramento-San Joaquin Delta Drainage contains 4,154 square miles, approximately 2,390 square miles of which are classified as mountain and foothill terrain.

A broad gentle-sloping plain, cut into islands by numerous waterways, lies between the foothills on the east and the Carquinez Strait on the west. This fertile agricultural land comprises an area of 1,764 square miles and is referred to as the Sacramento-San Joaquin Delta.

Prominent uses of water in the Delta include irrigation, power development, salinity control, recreation, and export under the operation of the Central Valley Project and the East Bay Municipal Utility District. Many varied industries are located in the western end of the Delta and they depend upon waters of the Delta for a source of process and cooling waters.

Twenty-three sampling stations are being monitored to obtain information and to provide a continuing check on quality of surface water resources in this drainage area. Monitoring basins with the number of sampling stations in parenthesis are as follows:

Sacramento-San Joaquin Delta (17)
Cosumnes River Basin (2)
Mokelumne River Basin (2)
Calaveras River Basin (2)

Sacramento-San Joaquin Delta (5c)

The Central Delta area comprises over 50 islands and tracts reclaimed, since 1852, from former tule swamps and overflow lands. Included in the area are about 469,000 acres lying generally below an elevation of 5 feet above sea level. A survey in 1955 determined that approximately 386,000 acres were agricultural and 83,000 acres nonagricultural. Acreage classified nonagricultural included approximately 42,000 acres of water surface made up of three major flooded areas and a maze of interconnected waterways.

The need of many public agencies for water quality data within the Delta prompted the planning and organization of a water quality surveillance program and the establishment of numerous monitoring stations on the maze of rivers, canals, and sloughs comprising the water channels in the Delta. The escaping of poor quality water trapped in the deadend portions of the Delta channels when heavy drafts at the Central Valley Project pumping plants induce movement, and the effect of irrigation and drainage practices, have caused considerable concern in the past.

The quality of water in the Delta area is influenced primarily by five factors: (a) the tidal motivated incursion of saline water from Suisun Bay into the Delta, (b) flow conditions in streams tributary to the Delta, (c) Central Valley Project diversions, (d) irrigation diversions to and return flows from the many irrigated islands in the Delta, and (e) accretions from ground water aquifers in the Delta.

During 1960 and 1961, maximum values of record for a number of mineral constituents were recorded at most stations in the Delta. Below normal tributary flows, coupled with increased demands on water during these years of drought, accounts for such extremes in quality.

The following tabulation presents the names of stations maintained to monitor quality of surface water in the Delta, and the page on which each is discussed:

Monitoring Station	Page Number of Station Discussion
Lindsey Slough near Rio Vista	322
Sacramento River at Rio Vista	324
Delta Cross Channel near Walnut Grove	326
Little Potato Slough at Terminous	328
San Joaquin River at Mossdale Bridge	330
San Joaquin River at Garwood Bridge	332
San Joaquin River at Antioch	334
Stockton Ship Channel on Rindge Island	336
Old River near Tracy	338
Old River at Clifton Court Ferry	340
Old River at Orwood Bridge	342
Old River at Mandeville Island	344
Grant Line Canal at Tracy Road Bridge	346
Delta-Mendota Canal Tracy	348
Italian Slough near Mouth	350
Indian Slough near Brentwood	352
Rock Slough near Knightsen	354

LINDSEY SLOUGH NEAR RIO VISTA (STA. 110)

Sampling Point. Station 110 is located in Section 25, Township 5 North, Range 2 East, Mt. Diablo Base and Meridian. Monthly grab samples are taken from the boat landing on the right bank at California Packing Corporation's Montezuma Ranch Headquarters, and about six miles north of Rio Vista, Solano County.

Period of Record. October 1952 through December 1961.

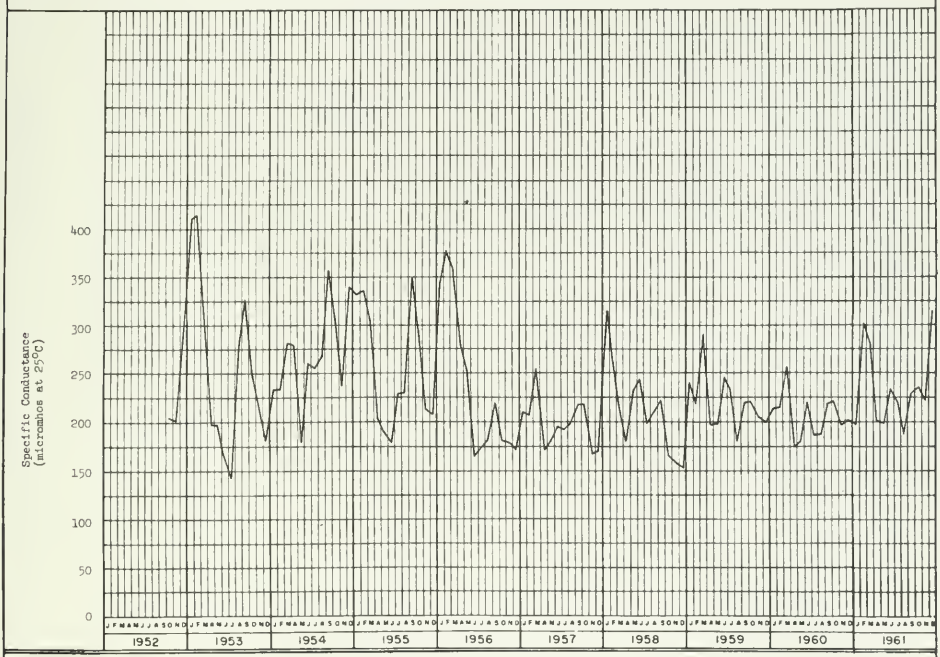
Water Quality Characteristics. The water is a complex calcium-magnesium-sodium bicarbonate type, low in mineral content, and well suited for domestic, industrial, and class 1 irrigation uses. Because tidal oscillations and pumping maintain a flushing action through the slough, the water quality at this station has remained fairly consistent throughout the period of record and generally reflects the quality of the Sacramento River at Rio Vista (Station 16).

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	377	143	313	188
Temperature in °F	80	44	76	45
Dissolved oxygen in parts per million	11.4	6.5	10.5	7.4
Percent saturation	104	69	94	76
pH	8.0	7.1	7.7	7.2
Mineral constituents in parts per million				
Calcium (Ca)	24	11	15	13
Magnesium (Mg)	19	6.5	9.6	8.5
Sodium (Na)	32	9.0	28	12
Potassium (K)	3.3	1.2	1.6	1.2
Carbonate (CO_3)	2	0	0	0
Bicarbonate (HCO_3)	160	56	107	83
Sulfate (SO_4)	25	11	15	13
Chloride (Cl)	29	6.0	29	9.4
Nitrate (NO_3)	1.4	0.4	1.2	0.4
Fluoride (F)	0.4	0.0	0.2	0.1
Boron (B)	0.7	0.00	0.3	0.0
Silica (SiO_2)	24	15	21	18
Total dissolved solids in parts per million	230	87	191	114
Percent sodium	51	22	39	28
Hardness as $CaCO_3$ in parts per million				
Total	139	42	94	68
Noncarbonate	12	0	7	0
Turbidity	700	7	120	25
Coliform in most probable number per milliliter	>7,000.	<0.045	2,400.	2.0
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.18	0.0	0.03	
Solid alpha	0.34	0.0	0.34	
Dissolved beta	8.2	0.0	8.2	
Solid beta	0.0	0.0	0.0	

WATER QUALITY VARIATIONS



LINDSEY SLOUGH NEAR RIO VISTA (STA. NO. 110)

SACRAMENTO RIVER AT RIO VISTA (STA. 16)

Sampling Point. Station 16 is located in Section 30, Township 4 North, Range 3 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the center of the channel of flow, from Highway 12 bridge at Rio Vista, Solano County.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Past analyses show the water at Station 16 to be a complex calcium-magnesium-sodium bicarbonate type, soft to slightly hard, consistently class 1 for irrigation use, and generally within mineral requirements for domestic use.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	326	109	235	163
Temparature in °F	78	43	74	44
Disolvad oxygen in parts per million	18.8	5.9	10.9	7.0
Percent saturation	178	64	100	76
pH	8.2	6.8	7.8	7.0
Mineral constituents in parts per million				
Calcium (Ca)	20	8.8	16	13
Magnesium (Mg)	12	4.3	9.5	6.7
Sodium (Na)	26	5.4	18	10
Potassium (K)	2.9	0.8	1.8	1.4
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	164	43	109	60
Sulfate (SO_4)	20	3.1	14	12
Chloride (Cl)	26	3.1	13	7.5
Nitrate (NO_3)	1.4	0.0	0.8	0.7
Fluoride (F)	0.4	0.0	0.1	0.0
Boron (B)	0.39	0.00	0.2	0.0
Silica (SiO_2)	26	14	21	18
Total dissolved solids in parts per million	204	68	146	102
Percent sodium	37	19	34	24
Hardness as $CaCO_3$ in parts per million				
Total	122	40	79	55
Noncerbonate	12	0	6	0
Turbidity	600	1	85	8
Coliform in most probable number per milliliter	70,000.	0.62	7,000.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.56	0.00	0.31	0.06
Solid elpha	0.79	0.00	0.47	0.10
Dissolved beta	20.20	0.00	6.2	1.7
Solid beta	11.41	0.00	8.2	2.4

WATER QUALITY VARIATIONS

SACRAMENTO RIVER AT RIO VISTA (STA. NO. 16)

DELTA CROSS CHANNEL NEAR WALNUT GROVE (STA. 98)

Sampling Point. Station 98 is located in Section 35, Township 5 North, Range 4 East, Mt. Diablo Base and Meridian. The monthly water samples were collected from the upstream side of the control gate structure, about 300 feet downstream from the head of the Delta Cross Channel, and approximately 0.3 mile northeast of Walnut Grove, Sacramento County.

Period of Record. September 1952 through December 1961.

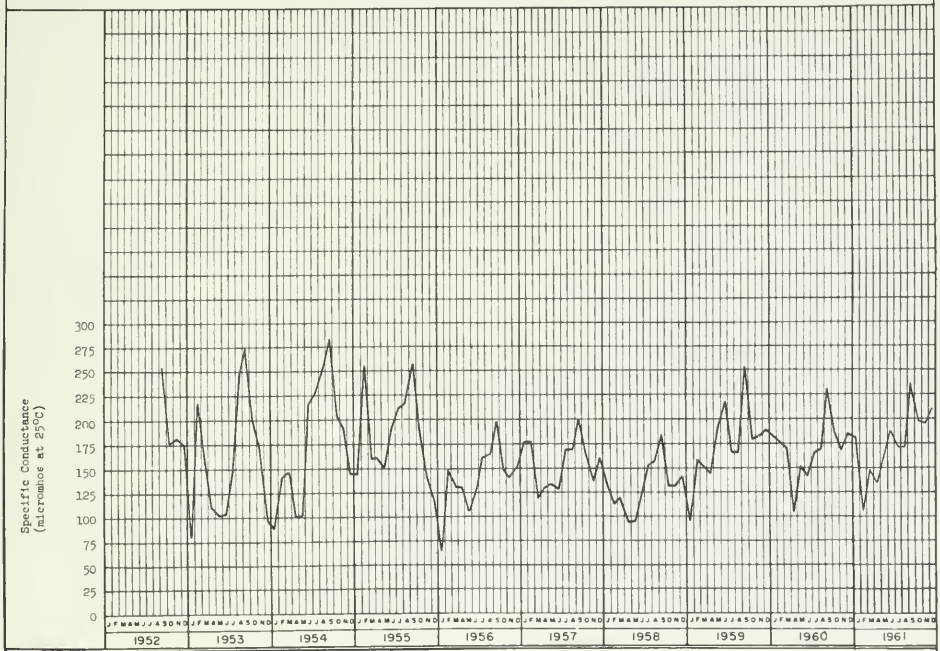
Water Quality Characteristics. Samples from Station 98 indicate the predominant cations to be calcium, magnesium, and sodium, and bicarbonate as the predominant anion. The water is in the soft to slightly hard range, and consistently meets drinking water standards for mineral content, is suitable for most industrial uses, and class 1 for irrigation.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	280	64.9	235	106
Temperature in °F	77	44	75	44
Dissolved oxygen in parts per million	12.2	5.7	11.2	6.6
Percent saturation	121	63	91	72
pH	8.2	6.8	7.5	6.9
Mineral constituents in parts per million				
Calcium (Ca)	20	5.9	16	12
Magnesium (Mg)	11	2.7	9.7	6.2
Sodium (Na)	24	1.6	17	5.0
Potassium (K)	2.9	0.5	1.7	1.5
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	123	33	108	48
Sulfate (SO_4)	19	4.0	13	8.8
Chloride (Cl)	20	1.3	12	3.6
Nitrate (NO_3)	2.1	0.0	0.6	0.0
Fluoride (F)	0.3	0.0	0.1	0.1
Boron (B)	0.59	0.00	0.1	0.0
Silica (SiO_2)	26	15	22	19
Total dissolved solids in parts per million	175	43	145	70
Percent sodium	37	15	33	19
Hardness as $CaCO_3$ in parts per million				
Total	90	28	80	46
Noncarbonate	13	0	7	0
Turbidity	340	0.9	145	7
Coliform in most probable number per milliliter	70,000.	0.62	1,300.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.43	0.0		
Solid alpha	0.32	0.0		
Dissolved beta	7.38	0.0		
Solid beta	7.0	0.0		

WATER QUALITY VARIATIONS



DELTA CROSS CHANNEL NEAR WALNUT GROVE (STA. NO. 98)

LITTLE POTATO SLOUGH AT TERMINOUS (STA. 99)

Sampling Point. Station 99 is located in Section 13, Township 3 North, Range 4 East, Mt. Diablo Base and Meridian. Monthly grab samples were taken from a boat dock on the east bank, about 250 feet north of State Highway 12 bridge, San Joaquin County.

Period of Record. September 1952 through December 1961.

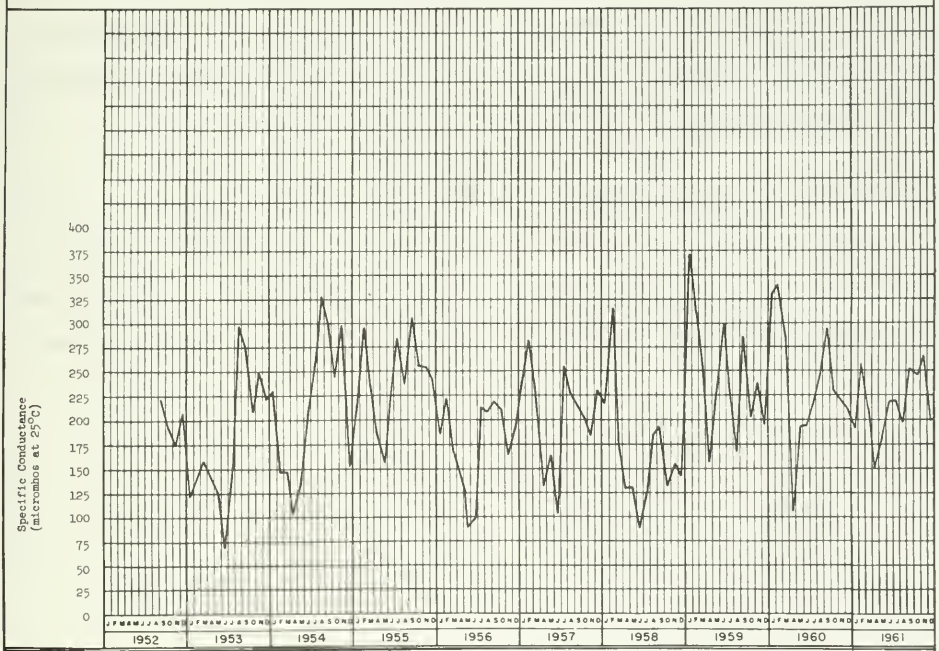
Water Quality Characteristics. Past analyses show the water to be a complex calcium-magnesium-sodium bicarbonate type and of excellent mineral quality, usually slightly hard, class 1 for irrigation, and suitable for domestic use.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	372	70	265	150
Temperature in °F	77	43	77	45
Dissolved oxygen in parts per million	10.9	5.1	10.4	6.9
Percent saturation	102	52	92	65
pH	7.7	6.8	7.6	6.9
Mineral constituents in parts per million				
Calcium (Ca)	24	5.2	16	13
Magnesium (Mg)	12	3.1	10	7.7
Sodium (Na)	32	3.3	19	8.4
Potassium (K)	2.0	0.7	1.6	1.3
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	127	24	102	54
Sulfate (SO_4)	21	2.4	13	11
Chloride (Cl)	52	5.5	32	9.0
Nitrate (NO_3)	7.8	0.0	0.0	0.0
Fluoride (F)	0.5	0.0	0.2	0.1
Boron (B)	1.1	0.00	0.2	0.0
Silica (SiO_2)	25	11	19	19
Total dissolved solids in parts per million	223	42	159	90
Percent sodium	42	5	36	24
Hardness as $CaCO_3$ in parts per million				
Total	143	26	89	59
Noncarbonate	68	0	28	0
Turbidity	150	2	46	10
Coliform in most probable number per milliliter	>7,000.	0.23	7,000.	6.2
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.31	0.0	0.31	0.0
Solid alpha	0.36	0.00	0.0	0.00
Dissolved beta	16.50	0.0	2.1	1.5
Solid beta	0.2	0.00	0.2	0.1

WATER QUALITY VARIATIONS



LITTLE POTATO SLOUGH AT TERMINOUS (STA. NO. 99)

SAN JOAQUIN RIVER AT MOSSDALE BRIDGE (STA. 102)

Sampling Point. Station 102 is located in Section 4, Township 2 South, Range 6 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from a boat landing on the left bank, just downstream from Mossdale Bridge on U. S. Highway 50, about 12.0 miles south of Stockton and 7.0 miles northeast of Tracy, San Joaquin County.

Period of Record. September 1952 through December 1961.

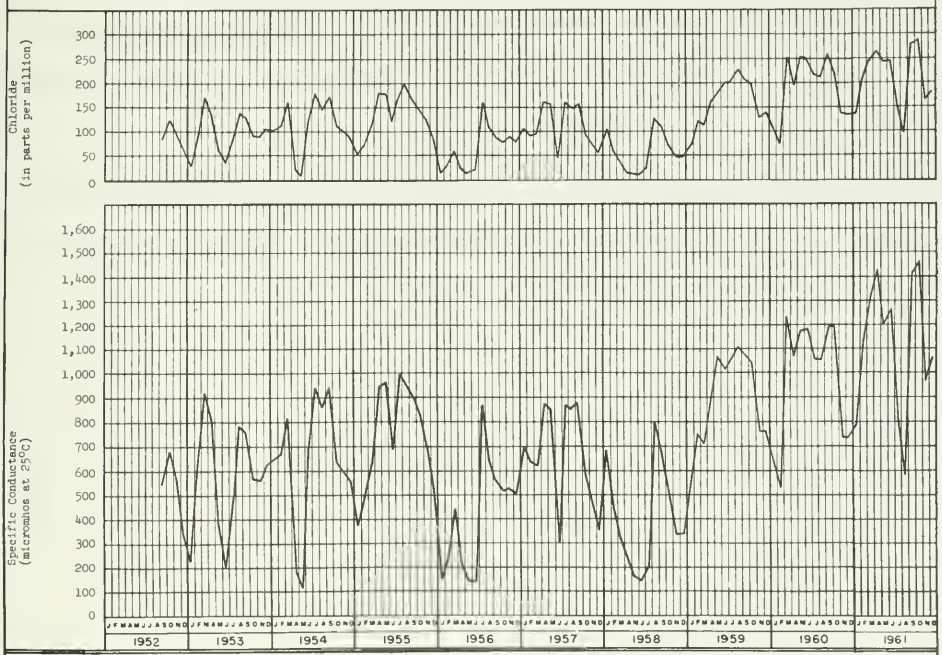
Water Quality Characteristics. Water at Station 102 is predominantly a sodium-chloride type, moderately hard to very hard, and not recommended for domestic uses. During summer months, and for longer periods in dry years, concentrations of dissolved solids and chlorides are often sufficiently high to place the water in class 2 for irrigation. Wide seasonal variations in quality are characteristic of water at this station. The quality of water at this station is influenced by tidal action, fresh water inflow to the Delta, irrigation diversion and return flows, and ground water accretions.

Significant Water Quality Changes. During October 1961, maximum values of record for specific conductance (1460 micromhos), chloride concentration (289 ppm), boron content (0.6 ppm), and total hardness (320 ppm) were obtained. This is probably attributable to low flow conditions, 1961 being a third consecutive dry year.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	1,460	102	1,460	580
Temperature in °F	82	44	80	44
Dissolved oxygen in parts per million	16.6	4.4	15.2	6.8
Percent saturation	176	51	151	72
pH	8.5	6.8	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	67	7.2	67	59
Magnesium (Mg)	44	2.2	33	29
Sodium (Na)	190	7.6	190	61
Potassium (K)	8.0	0.7	6.0	5.6
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	224	32	224	124
Sulfate (SO_4)	115	10	91	70
Chloride (Cl)	289	9.3	289	97
Nitrate (NO_3)	3.7	0.0	0.8	0.5
Fluoride (F)	0.4	0.0	0.2	0.1
Boron (B)	0.6	0.0	0.6	0.2
Silica (SiO_2)	34	9.3	23	14
Total dissolved solids in parts per million	826	58	826	328
Percent sodium	57	32	56	48
Hardness as $CaCO_3$ in parts per million				
Total	320	28	320	141
Noncarbonate	170	0	170	26
Turbidity	125	0	45	3
Coliform in most probable number per milliliter	>7,000.	<0.045	7,000.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.1	0.0	0.84	0.31
Solid alpha	0.5	0.00	0.56	0.42
Dissolved beta	16.2	0.0	6.0	1.
Solid beta	10.90	0.0	7.1	0.0

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER AT MOSSDALE BRIDGE (STA. NO. 102)

SAN JOAQUIN RIVER AT GARWOOD BRIDGE (STA. 101)

Sampling Point. The station is located in Section 16, Township 1 North, Range 6 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from a boat landing on the left bank, upstream from State Highway 4 bridge near Stockton, San Joaquin County.

Period of Record. September 1952 through December 1961.

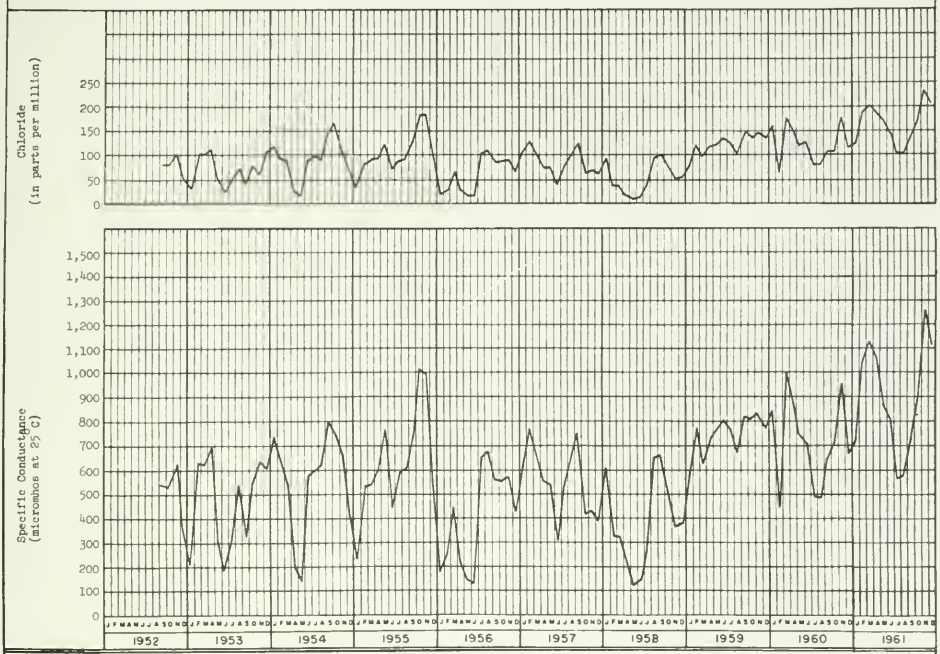
Water Quality Characteristics. Water at Station 101 is predominantly sodium-chloride in character, moderately hard to very hard, and usually class 1 for irrigation. The water meets drinking water standards and is suitable for domestic use. Analyses of samples collected at this station indicate that Sacramento River water, which traverses the Delta through the many interconnected channels, and water from other streams tributary to the Delta, significantly affects the quality of the San Joaquin River at Garwood Bridge. The quality generally improves at the Garwood Bridge station when mineral concentrations are compared to the next upstream station at Mossdale Bridge (Station 102).

Significant Water Quality Changes. During 1961, specific conductance, sodium, chloride, and total hardness values of 1260 micromhos, 152 ppm, 233 ppm, and 279 ppm, respectively, established new maximums of record.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,260	109	1,260	573
Temperature in °F	82	44	82	47
Dissolved oxygen in parts per million	13.3	0.5	13.3	3.6
Percent saturation	141	5.8	141	45
pH	8.4	6.8	8.4	7.3
Mineral constituents in parts per million				
Calcium (Ca)	54	7.8	41	32
Magnesium (Mg)	23	2.5	23	18
Sodium (Na)	152	9.2	152	56
Potassium (K)	8.0	1.2	6.2	6.0
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	208	37	208	99
Sulfate (SO_4)	61	5.8	61	29
Chloride (Cl)	233	11	233	102
Nitrate (NO_3)	4.7	0.4	1.4	1.2
Fluoride (F)	0.5	0.0	0.2	0.2
Boron (B)	2.1	0.00	0.5	0.0
Silica (SiO_2)	23	0.5	1.4	0.5
Total dissolved solids in parts per million	713	69	713	324
Percent sodium	58	37	58	49
Hardness as $CaCO_3$ in parts per million				
Total	279	31	279	125
Noncarbonate	108	0	108	10
Turbidity	310	0	32	3
Coliform in most probable number per milliliter	>24,000.	0.62	>7,000.	23.
Radioactivity in micro-micro curies per liter				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid bete				

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER AT GARWOOD BRIDGE (STA. NO. 101)

SAN JOAQUIN RIVER AT ANTIOCH (STA. 28)

Sampling Point. The Antioch station is located in Section 18, Township 2 North, Range 2 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank at Old Antioch Water Works Pier, Fulton Shipyard Road, near the northeast city limits of Antioch, Contra Costa County.

Period of Record. April 1951 through December 1961.

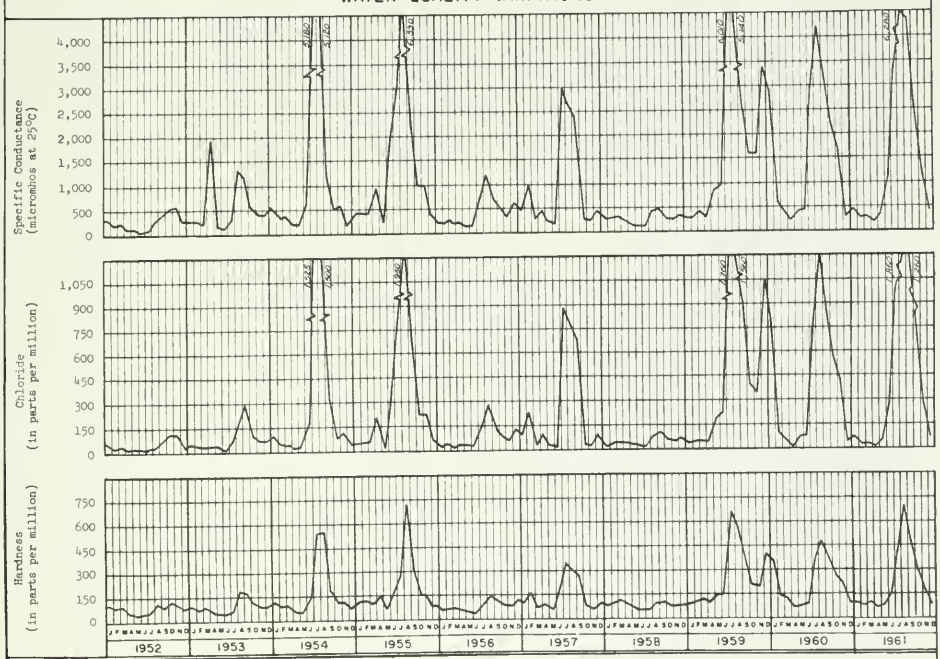
Water Quality Characteristics. Quality of water in the San Joaquin River at Antioch is affected by sea water from Suisun Bay and during periods when flows are insufficient to repel sea water incursion, the water is sodium-chloride in character, poor in quality, class 3 for irrigation, and unsuitable for nearly all domestic and industrial uses. In the winter and spring when river outflow from the Delta increases, the water is usually sodium-bicarbonate in character, excellent in quality, class 1 for irrigation, and within mineral quality requirements for domestic use.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	6,780	101	6,280	108
Temperature in °F	78	42	78	47
Dissolved oxygen in parts per million	18.0	7.0	9.7	7.1
Percent saturation	177	70	105	73
pH	8.0	6.8	7.8	6.9
Mineral constituents in parts per million				
Calcium (Ca)	61	8.0	43	17
Magnesium (Mg)	138	2.0	88	6.6
Sodium (Na)	1,050	7.1	1,030	11
Potassium (K)	42	1.0	25	2.0
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	130	35	109	75
Sulfate (SO_4)	294	7.0	143	22
Chloride (Cl)	1,950	3.5	1,860	15
Nitrate (NO_3)	6.3	0.1	2.5	0.2
Fluoride (F)	1.2	0.0	0.1	0.0
Boron (B)	1.1	0.00	0.6	0.0
Silica (SiO_2)	23	0.4	16	0.9
Total dissolved solids in parts per million	3,980	56	3,150	109
Percent sodium	77	30	76	30
Hardness as $CaCO_3$ in parts per million				
Total	700	30	504	70
Noncarbonate	440	0	420	0
Turbidity	150	1	70	2
Coliform in most probable number per milliliter	24,000.	0.3	2,400.	6.2
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.73	0.00	0.38	0.00
Solid alpha	1.46	0.00	0.28	0.14
Dissolved beta	18.15	0.00	1.7	0.0
Solid beta	16.35	0.00	0.0	0.0

WATER QUALITY VARIATIONS



SAN JOAQUIN RIVER AT ANTIOCH (STA. NO. 28)

STOCKTON SHIP CHANNEL ON RINDGE ISLAND (STA. 100)

Sampling Point. Stockton Ship Channel Station is located in Section 28, Township 2 North, Range 5 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected on the right bank of the ship channel, at the southeast corner of Rindge Tract, and near the junction of Fourteen Mile Slough in San Joaquin County.

Period of Record. September 1952 through December 1961.

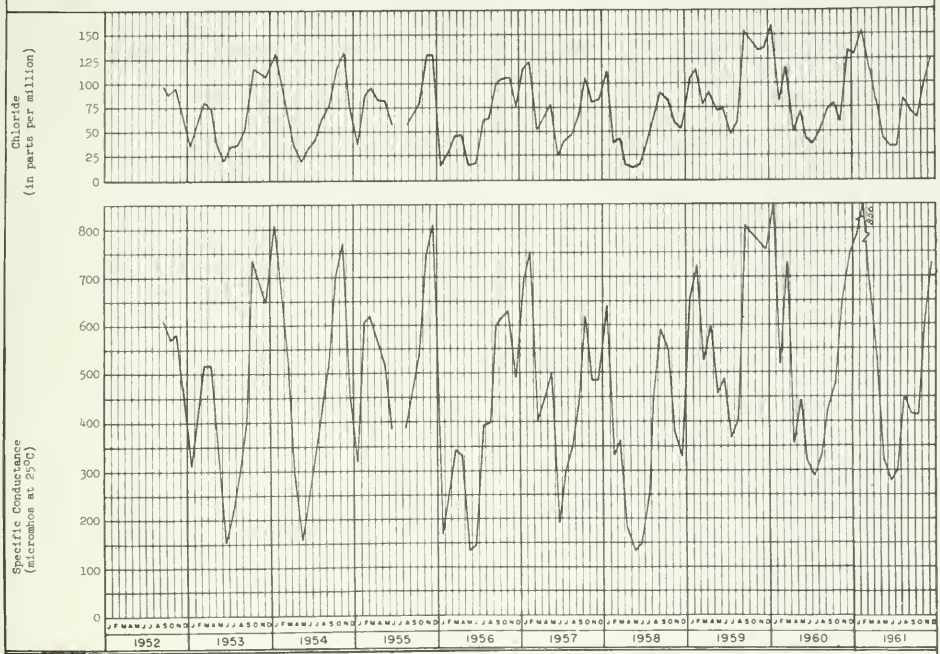
Water Quality Characteristics. Past analyses indicate the water to be predominantly of the sodium bicarbonate-chloride type, in the slightly hard to moderately hard range, class 1 for irrigation, and suitable for domestic use.

Significant Water Quality Changes. In January 1960, maximums of record were established for specific conductance (850 micromhos) and chloride (158 ppm).

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	356	135	[illegible]	279
Temperature in °F	84	[illegible]	[illegible]	[illegible]
Dissolved oxygen in parts per million	12.5	[illegible]	10.	[illegible]
Percent saturation	138	[illegible]	110	[illegible]
pH	8.4	[illegible]	8.1	[illegible]
Mineral constituents in parts per million				
Calcium (Ca)	50	[illegible]	12	17
Magnesium (Mg)	22	[illegible]	13	11
Sodium (Na)	107	12	88	24
Potassium (K)	8.6	1.2	2.4	1.[illegible]
Carbonate (CO_3)	[illegible]	[illegible]	[illegible]	[illegible]
Bicarbonate (HCO_3)	198	42	130	93
Sulfate (SO_4)	98	7.6	21	19
Chloride (Cl)	158	14	153	33
Nitrate (NO_3)	14	[illegible]	2.7	[illegible]
Fluoride (F)	0.6	[illegible]	[illegible]	[illegible]
Boron (B)	[illegible]	[illegible]	0.3	[illegible]
Silica (SiO_2)	23	3.4	19	15
Total dissolved solids in parts per million	476	83	476	155
Percent sodium	57	33	55	38
Hardness as $CaCO_3$ in parts per million				
Total	210	36	198	85
Noncerbonate	124	0	102	12
Turbidity	125	1	85	15
Coliform in most probable number per milliliter	>24,000.	0.62	>7,000.	23.
Radioactivity in micro-micro curies per liter				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid beta				

WATER QUALITY VARIATIONS



STOCKTON SHIP CHANNEL ON RINDGE ISLAND (STA. NO. 100)

OLD RIVER NEAR TRACY (STA. 103)

Sampling Point. Station 103 is located in Section 6, Township 2 South, Range 5 East, Mt. Diablo Base and Meridian. Samples were collected from the trash rack of the Naglee Burke Irrigation District pump intake on the left bank, 500 feet from Lammers Road, about 5.0 miles northwest of Tracy, San Joaquin County.

Period of Record. October 1952 through December 1961.

Water Quality Characteristics. Water at Station 103 is predominantly sodium-chloride in character, in the moderately hard to very hard ranges, frequently class 2 for irrigation, and does not meet drinking water requirements due to high chloride content.

Significant Water Quality Changes. The 1961 maximum values were as follows: electrical conductivity, 1470 micromhos; sodium, 171 ppm; sulfate, 107 ppm; chloride, 315 ppm; boron, 0.7 ppm; and total hardness, 356 ppm. These values established new maximums for the period of record. Low flow conditions in streams tributary to the Delta probably account for these maximum values.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,476	135	1,[illegible]75	714
Temperature in °F	81	44	81	45
Dissolved oxygen in parts per million	14.0	5.1	11.[illegible]	5.6
Percent saturation	170	44	136	60
pH	8.5	7.[illegible]	[illegible].3	7.3
Mineral constituents in parts per million				
Calcium (Ca)	67	5.2	61	53
Magnesium (Mg)	32	3.8	31	28
Sodium (Na)	171	12	171	67
Potassium (K)	7.4	1.2	6.2	5.0
Carbonate (CO_3)	6	0	0	0
Bicarbonate (HCO_3)	232	38	232	129
Sulfate (SO_4)	107	9.1	107	66
Chloride (Cl)	315	17	315	124
Nitrate (NO_3)	5.1	[illegible].1	[illegible].2	0.2
Fluoride (F)	0.4	[illegible].5	[illegible].2	0.1
Boron (B)	0.7	0.00	0.7	0.2
Silica (SiO_2)	27	2.1	[illegible].4	7.1
Total dissolved solids in parts per million	825	81	825	401
Percent sodium	54	37	54	44
Hardness as $CaCO_3$ in parts per million				
Total	356	36	356	160
Noncarbonate	178	3	178	48
Turbidity	110	0	31	4
Coliform in most probable number per milliliter	>7,000.	0.62	>7,000.	1.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	[illegible].9	[illegible].4	[illegible].[illegible]	[illegible].[illegible]
Solid alpha	5.60	0.0	[illegible].[illegible]	0.0
Dissolved beta	15.61	4.0	[illegible].[illegible]	[illegible].0
Solid beta	7.7	[illegible].[illegible]	[illegible].6	[illegible].0

WATER QUALITY VARIATIONS

OLD RIVER NEAR TRACY (STA. NO. 103)

OLD RIVER AT CLIFTON COURT FERRY (STA. 104)

Sampling Point. Station 104 is located in Section 20, Township 1 South, Range 4 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the ferry slip on the left bank, about 0.3 mile downstream from the tide stage recorder, 10.0 miles northwest of Tracy, and 6.0 miles southeast of Byron, Contra Costa County.

Period of Record. September 1952 through December 1961.

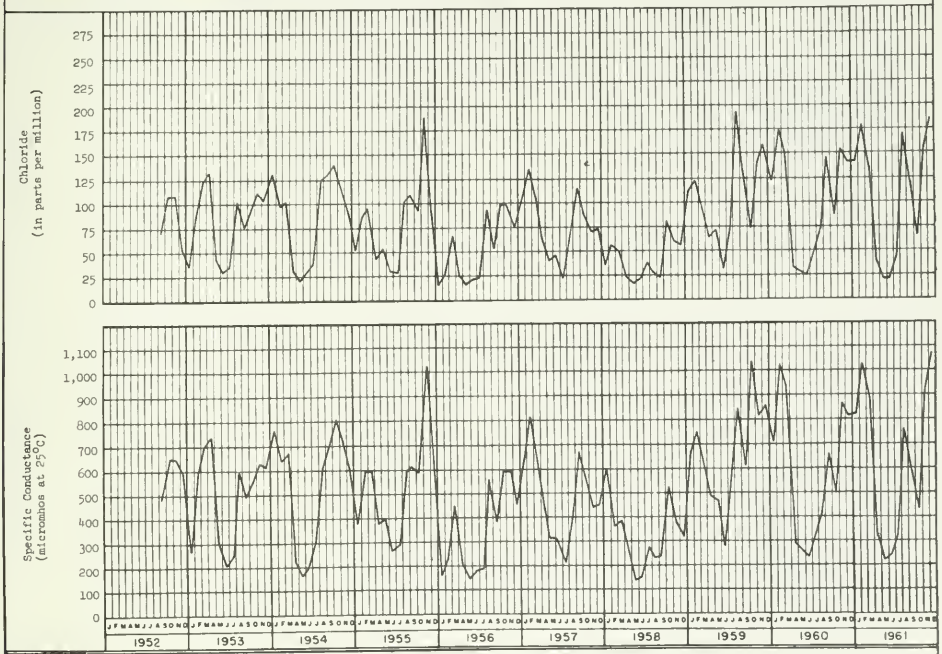
Water Quality Characteristics. Past analyses indicate the water to be predominantly sodium chloride in character, in the slightly hard to very hard ranges, and occasionally class 2 for irrigation due to high electrical conductivity and chloride concentrations associated with sea-water incursion and poor quality San Joaquin River inflows.

Significant Water Quality Changes. A maximum value of record for boron of 0.5 ppm in March 1960 placed the water in class 2 for irrigation at the time the sample was taken.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,070	140	1,070	214
Temperature in °F	82	43	78	45
Dissolved oxygen in parts per million	12.2	5.7	10.8	5.7
Percent saturation	118	61	105	61
pH	8.5	6.8	8.2	7.1
Mineral constituents in parts per million				
Calcium (Ca)	52	9.4	18	15
Magnesium (Mg)	23	3.3	16	8.4
Sodium (Na)	121	12	121	16
Potassium (K)	5.0	1.2	3.3	1.6
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	182	40	182	70
Sulfate (SO_4)	79	10	25	17
Chloride (Cl)	192	14	184	21
Nitrate (NO_3)	4.7	0.1	0.9	0.1
Fluoride (F)	0.7	0.0	0.2	0.2
Boron (B)	0.5	0.00	0.5	0.0
Silica (SiO_2)	31	3.9	17	16
Total dissolved solids in parts per million	609	80	609	130
Percent sodium	67	32	63	32
Hardness as $CaCO_3$ in parts per million				
Total	248	38	248	72
Noncarbonate	139	1	139	10
Turbidity	120	1	50	10
Coliform in most probable number per milliliter	>7,000.	0.2	>7,000.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	3.16	0.00	0.35	0.03
Solid alpha	2.51	0.0	0.35	0.15
Dissolved beta	11.35	0.0	0.5	0.0
Solid beta	17.0	0.0	17.3	0.0

WATER QUALITY VARIATIONS



OLD RIVER AT CLIFTON COURT FERRY (STA. NO. 104)

OLD RIVER AT ORWOOD BRIDGE (STA. 108)

Sampling Point. Station 108 is located in Section 17, Township 1 North, Range 4 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from a boat dock on the right bank at Atchison, Topeka, and Santa Fe Railroad bridge, and about 6.0 miles northeast of Byron in San Joaquin County.

Period of Record. September 1952 through December 1961.

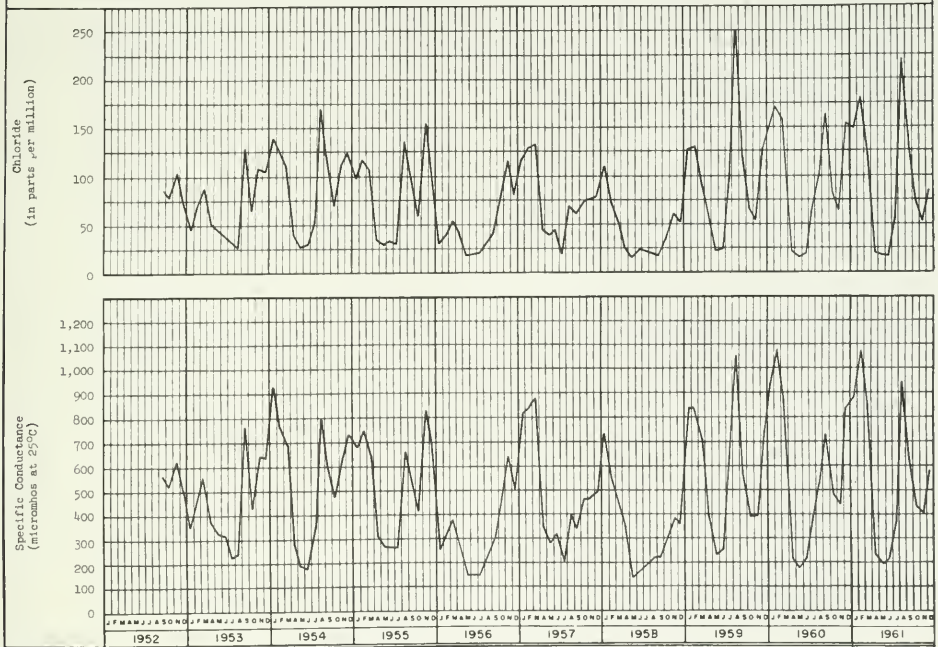
Water Quality Characteristics. Past analyses show the water to be predominantly sodium chloride in character, in the slightly hard to very hard ranges, and usually class 1 for irrigation. Water from Old River meets mineral requirements for domestic use.

Significant Water Quality Changes. Boron and total hardness reached record highs of 0.6 ppm and 270 ppm, respectively, at this station in 1960.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	1,280	118	1,070	196
Temperature in °F	79	43	79	43
Dissolved oxygen in parts per million	10.6	6.2	10.3	6.5
Percent saturation	97	65	96	65
pH	8.1	7.0	8.0	7.0
Mineral constituents in parts per million				
Calcium (Ca)	55	9.0	18	14
Magnesium (Mg)	27	3.0	18	6.4
Sodium (Na)	153	11	126	17
Potassium (K)	4.3	1.2	4.0	1.2
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	166	42	118	71
Sulfate (SO_4)	132	7.7	71	15
Chloride (Cl)	250	14	220	16
Nitrate (NO_3)	13	0.0	1.3	0.0
Fluoride (F)	0.5	0.0	0.2	0.1
Boron (B)	0.6	0.00	0.6	0.0
Silica (SiO_2)	26	6.4	18	16
Total dissolved solids in parts per million	607	86	602	122
Percent sodium	68	29	66	32
Hardness as $CaCO_3$ in parts per million				
Total	270	36	260	61
Noncarbonate	177	2	163	3
Turbidity	140	3	50	11
Coliform in most probable number per milliliter	>7,000.	0.62	2,400.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.24	0.0	0.24	0.03
Solid alpha	1.56	0.0	0.47	0.12
Dissolved beta	12.72	0.00	7.8	0.2
Solid beta	9.13	0.0	6.2	0.0

WATER QUALITY VARIATIONS



OLD RIVER AT ORWOOD BRIDGE (STA. NO. 108)

OLD RIVER AT MANDEVILLE ISLAND (STA. 112)

Sampling Point. Station 112 is located in Section 6, Township 2 North, Range 4 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, on the northwest side of Mandeville Island, approximately 1 mile from the mouth of Old River and about 5 miles northwest of Mandeville School along the levee road in San Joaquin County.

Period of Record. December 1954 through December 1961.

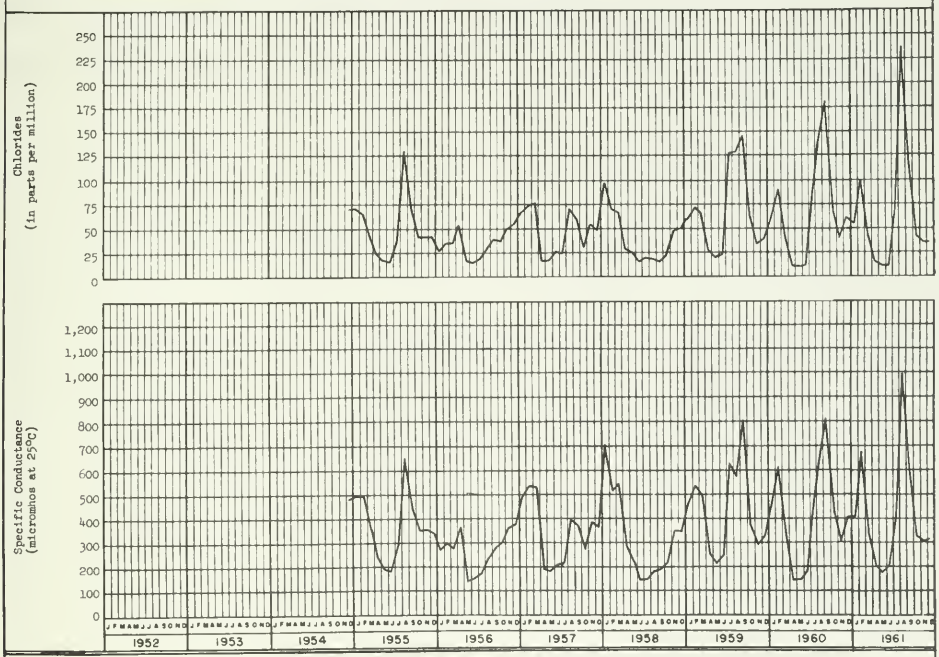
Water Quality Characteristics. Past analyses show the water to be a complex sodium-calcium-magnesium bicarbonate-chloride type, in the soft to moderately hard ranges, within drinking water standards for mineral content, and usually class 1 for irrigation.

Significant Water Quality Changes. During August 1961, specific conductance, sodium, and chloride values of 997 micromhos, 135 ppm, and 237 ppm, respectively, established new maximums of record.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	997	138	997	177
Temperature in °F	81	43	81	43
Dissolved oxygen in parts per million	11.0	6.1	10.1	6.9
Percent saturation	100	67	100	79
pH	8.1	7.0	7.7	7.1
Mineral constituents in parts per million				
Calcium (Ca)	38	9.6	19	13
Magnesium (Mg)	19	3.9	13	7.2
Sodium (Na)	135	8.2	135	12
Potassium (K)	9.4	1.2	4.3	1.4
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	194	42	107	72
Sulfate (SO_4)	68	1.0	29	11
Chloride (Cl)	237	11	237	12
Nitrate (NO_3)	8.1	0.3	1.2	0.4
Fluoride (F)	2.0	0.0	0.1	0.1
Boron (B)	0.50	0.00	0.3	0.0
Silica (SiO_2)	22	11	19	16
Total dissolved solids in parts per million	578	81	578	111
Percent sodium	68	27	68	29
Hardness as $CaCO_3$ in parts per million				
Total	217	40	184	62
Noncarbonate	129	0	110	2
Turbidity	110	3	110	15
Coliform in most probable number per milliliter	>7,000.	1.3	>7,000.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.26	0.0	0.03	
Solid alpha	0.19	0.0	0.19	
Dissolved beta	10.95	0.0	4.6	
Solid beta	2.2	0.0	2.2	

WATER QUALITY VARIATIONS



OLD RIVER AT MANDEVILLE ISLAND (STA. NO. 112)

GRANT LINE CANAL AT TRACY ROAD BRIDGE (STA. 103a)

Sampling Point. Station 103a is located in Section 29, Township 1 South, Range 5 East, Mt. Diablo Base and Meridian. The monthly water samples were collected from a boat dock at Tracy Road bridge approximately 5.0 miles north of Tracy, in San Joaquin County.

Period of Record. July 1958 through December 1961.

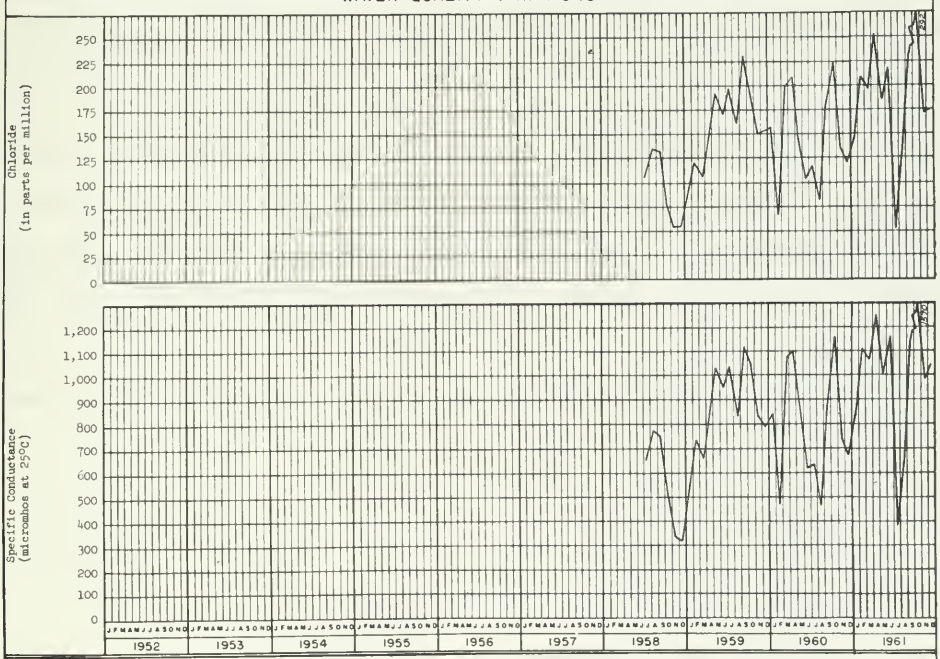
Water Quality Characteristics. Past analyses indicate the water to be sodium chloride in type, in the slightly hard to moderately hard ranges, and class 2 for irrigation during several months of the year due to high conductivity.

Significant Water Quality Changes. The 1961 maximum values for conductivity (1570 micromhos), sodium (174 ppm), chloride (292 ppm), total dissolved solids (914 ppm), and total hardness (308 ppm), established new maximums of record. The past three years of below normal tributary inflows probably account for the poor quality of this water.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,570	332	1,570	380
Temperature in °F	80	44	80	46
Dissolved oxygen in parts per million	13.3	4.9	12.6	6.7
Percent saturation	151	59	120	78
pH	8.5	7.2	8.5	7.3
Mineral constituents in parts per million				
Calcium (Ca)	64	18	54	50
Magnesium (Mg)	30	7.5	28	23
Sodium (Na)	174	35	174	35
Potassium (K)	5.6	1.4	5.4	5.0
Carbonate (CO_3)	12	0	0	0
Bicarbonate (HCO_3)	208	67	208	98
Sulfate (SO_4)	77	33	69	62
Chloride (Cl)	292	52	292	52
Nitrate (NO_3)	2.7	0.0	0.7	0.1
Fluoride (F)	0.4	0.0	0.2	0.1
Boron (B)	0.5	0.0	0.5	0.1
Silica (SiO_2)	24	0.2	1.2	1.0
Total dissolved solids in parts per million	914	198	914	221
Percent sodium	56	43	55	43
Hardness as $CaCO_3$ in parts per million				
Total	308	76	308	100
Noncarbonate	147	20	147	20
Turbidity	110	6	47	7
Coliform in most probable number per milliliter	7,000.	0.23	620.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha				
Solid alpha				
Dissolved beta				
Solid beta				

WATER QUALITY VARIATIONS



GRANT LINE CANAL AT TRACY ROAD BRIDGE (STA. NO. 103a)

DELTA-MENDOTA CANAL NEAR TRACY (STA. 93)*

Sampling Point. Station 93 is located in Section 30, Township 1 South, Range 4 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank downstream from Byron-Bethany Road crossing about 1.0 mile northeast of the Tracy Pumping Plant, and about 10.0 miles northwest of Tracy, in Contra Costa County. Daily samples have also been collected from the canal since July 1955. The latter have been taken from the canal after the water has been lifted (pumped) from the intake.

Period of Record. July 1952 through December 1961.

Water Quality Characteristics. The water at Station 93 is predominantly sodium chloride in character, changing to sodium bicarbonate during periods of increased runoff. The water is in the slightly hard to very hard ranges, meets drinking water standards for mineral content, and ranges from class 1 to class 2 for irrigation.

Significant Water Quality Changes. The 1961 maximum values for specific conductance (1230 micromhos), sulfate (140 ppm), and total hardness (288 ppm), established maximums of record. High conductivity, boron, and chloride concentrations placed the water in class 2 during four months in 1960 and eight months in 1961.

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* Discussion of the quality of water at the terminus of the Delta-Mendota Canal will be found on page 286.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,230	146	1,230	221
Temperature in °F	80	42	80	48
Dissolved oxygen in parts per million	13.1	6.2	12.4	6.6
Percent saturation	130	65	115	69
pH	8.4	6.8	8.3	7.3
Mineral constituents in parts per million				
Calcium (Ca)	61	8.8	61	16
Magnesium (Mg)	33	2.9	33	7.7
Sodium (Na)	147	13	144	16
Potassium (K)	6.8	1.0	5.6	1.2
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	204	38	204	75
Sulfate (SO_4)	140	5.8	140	16
Chloride (Cl)	258	17	216	21
Nitrate (NO_3)	9.4	0.00	9.4	0.0
Fluoride (F)	0.5	0.0	0.3	0.0
Boron (B)	1.1	0.00	0.9	0.0
Silica (SiO_2)	32	10	32	16
Total dissolved solids in parts per million	737	93	737	136
Percent sodium	67	31	63	31
Hardness as $CaCO_3$ in parts per million				
Total	288	41	288	74
Noncarbonate	161	2	161	4
Turbidity	140	1	110	5
Coliform in most probable number per milliliter	>7,000.	0.23	620.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.27	0.00	0.08	0.06
Solid alpha	2.88	0.09	0.82	0.24
Dissolved beta	12.39	0.0	9.2	0.0
Solid beta	7.7	0.00	6.5	1.0

WATER QUALITY VARIATIONS

DELTA-MENDOTA CANAL NEAR TRACY (STA. NO. 93)

ITALIAN SLOUGH NEAR MOUTH (STA. 106)

Sampling Point. Station 106 is located in Section 7, Township 1 South, Range 4 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the right bank, at a pump house on the northwestern side of Clifton Court Tract, and about 3.0 miles southeast of Byron, in Contra Costa County.

Period of Record. September 1952 through December 1961.

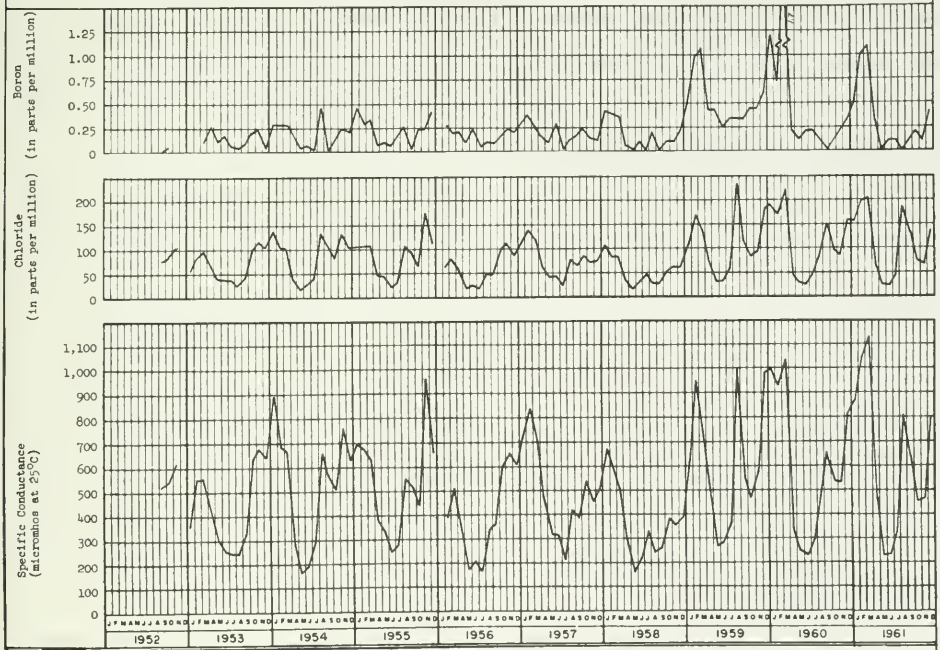
Water Quality Characteristics. Water in Italian Slough is predominantly sodium chloride in character, in the slightly hard to very hard ranges, and suitable for domestic use. The water is occasionally class 2 for irrigation due to high conductivity, high boron and sodium concentrations. Italian Slough, one of several dead-end sloughs in the southwestern Delta, is used as an intake channel by the Byron-Bethany Irrigation District to divert water during the irrigation season from Old River to a portion of the Delta Uplands area. Due to the proximity of this station to Old River, the quality of water in the slough is largely dependent upon the quality of water in Old River.

Significant Water Quality Changes. A conductivity value of 1130 micromhos established in March 1961 is a record maximum value.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,130	149	1,130	226
Temperature in °F	84	45	82	46
Dissolved oxygen in parts per million	13.3	6.1	13.3	6.7
Percent saturation	138	62	138	69
pH	8.3	6.8	8.3	7.1
Mineral constituents in parts per million				
Calcium (Ca)	51	9.3	18	17
Magnesium (Mg)	22	3.5	17	7.4
Sodium (Na)	148	13	141	19
Potassium (K)	4.6	1.2	3.4	1.5
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	151	39	147	77
Sulfate (SO_4)	41	11	24	19
Chloride (Cl)	232	16	204	20
Nitrate (NO_3)	1.8	0.0	0.6	0.0
Fluoride (F)	0.4	0.0	0.2	0.1
Boron (B)	1.7	0.00	1.1	0.0
Silica (SiO_2)	25	3.2	16	16
Total dissolved solids in parts per million	645	88	645	133
Percent sodium	68	33	63	35
Hardness as $CaCO_3$ in parts per million				
Total	233	38	233	73
Noncarbonate	135	3	112	10
Turbidity	85	2	40	3
Coliform in most probable number per milliliter	>7,000.	0.5	230.	0.5
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.17	0.0	0.17	0.15
Solid alpha	3.12	0.0	0.17	0.06
Dissolved beta	9.0	0.0	9.0	4.7
Solid beta	15.0	0.0	15.0	6.3

WATER QUALITY VARIATIONS



ITALIAN SLOUGH NEAR MOUTH (STA. NO. 106)

INDIAN SLOUGH NEAR BRENTWOOD (STA. 107)

Sampling Point. Station 107 is located in Section 23, Township 1 North, Range 3 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the East Contra Costa Irrigation District Canal at Pump No. 1 on Bixler Road, at the head of Indian Slough, and approximately 3.0 miles north of Byron, Contra Costa County.

Period of Record. September 1952 through December 1961.

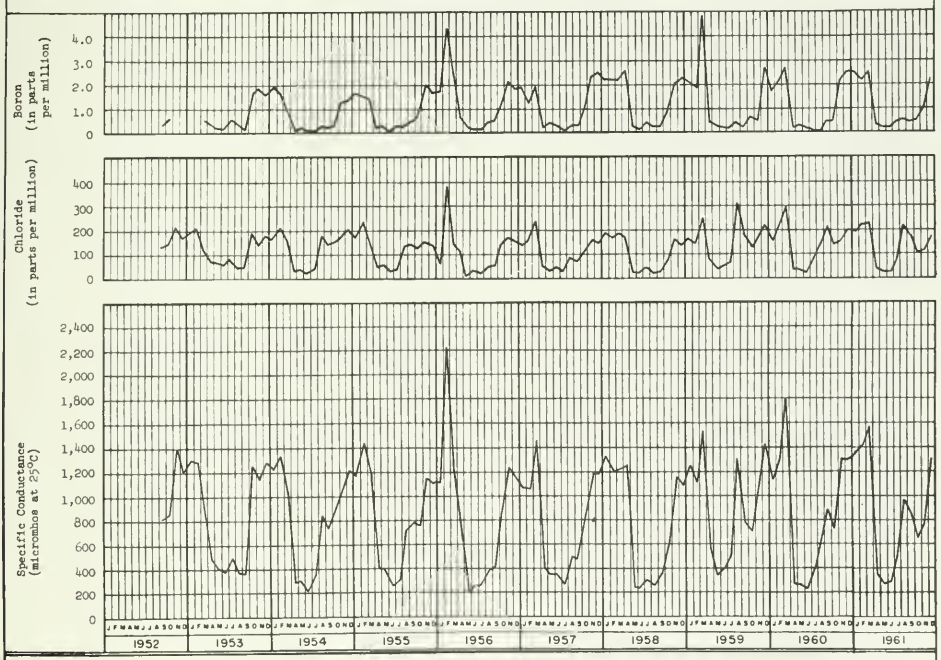
Water Quality Characteristics. Past analyses show the water to be predominantly sodium chloride or sodium bicarbonate, probably depending on whether the effects of accretions from ground water and surface drainage or of sea-water incursion predominate. The water ranges from slightly hard to very hard, does not consistently meet drinking water requirements for mineral content due to occasionally high chloride concentration, and is frequently class 2 or 3 for irrigation due to high conductivity, chloride, and boron.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	2,220	189	1,570	269
Temperature in °F	83	46	82	46
Dissolved oxygen in parts per million	16.1	5.3	10.7	6.1
Percent saturation	149	61	93	73
pH	8.4	6.8	8.1	7.3
Mineral constituents in parts per million				
Calcium (Ca)	102	6.4	22	17
Magnesium (Mg)	77	4.7	24	9.8
Sodium (Na)	264	17	185	23
Potassium (K)	6.2	1.4	4.2	1.4
Carbonate (CO_3)	8	0	5	0
Bicarbonate (HCO_3)	370	49	358	88
Sulfate (SO_4)	78	15	48	22
Chloride (Cl)	390	19	230	26
Nitrate (NO_3)	3.7	0.6	1.9	0.6
Fluoride (F)	0.5	0.0	0.3	0.2
Boron (B)	4.9	0.0	2.5	0.2
Silica (SiO_2)	20	7.8	18	17
Total dissolved solids in parts per million	1,237	112	875	158
Percent sodium	69	33	63	37
Hardness as $CaCO_3$ in parts per million				
Total	570	48	367	83
Noncarbonate	275	5	109	11
Turbidity	160	1	51	2
Coliform in most probable number per milliliter	>7,000.	0.23	>7,000.	1.3
Radioactivity in micro-micro curiss per liter				
Dissolved alpha	1.87	0.00	0.03	0.00
Solid alpha	2.36	0.0	0.71	0.37
Dissolved beta	20.14	2.8	5.5	2.8
Solid beta	13.8	0.0	13.8	0.0

WATER QUALITY VARIATIONS



INDIAN SLOUGH NEAR BRENTWOOD (STA. NO. 107)

ROCK SLOUGH NEAR KNIGHTSEN (STA. 109)

Sampling Point. Station 109 is located in Section 33, Township 2 North, Range 3 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the Tule Lane bridge 300 feet south of Contra Costa Canal intake gates, and near the head of Rock Slough about 2.0 miles northeast of Knightsen, Contra Costa County.

Period of Record. September 1952 through December 1961.

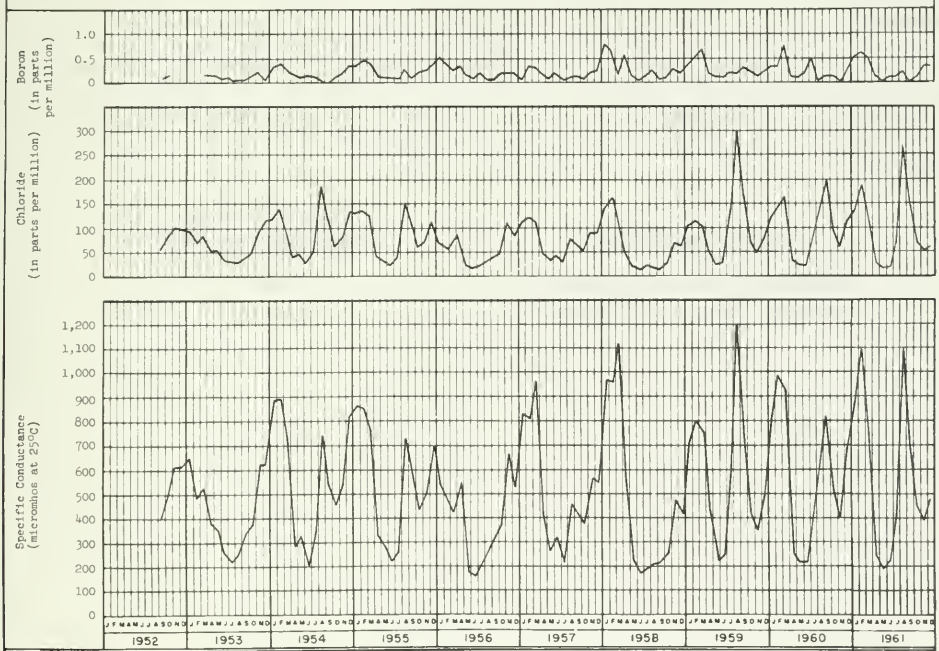
Water Quality Characteristics. Rock Slough water is generally a sodium chloride type, with seasonal variations in quality. These variations reflect the changing quality of Old River and are attributable to the effects of accretions from ground water, surface drainage, and sea-water incursion. The water is in the slightly hard to very hard ranges, usually class 1 for irrigation water, but is occasionally class 2 due to high concentrations of sodium and boron, and is suitable for domestic use from a mineral standpoint.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	1,190	118	1,100	190
Temperature in °F	91	44	80	45
Dissolved oxygen in parts per million	21.0	4.5	10.0	6.0
Percent saturation	115	51	94	71
pH	7.9	6.8	7.5	7.1
Mineral constituents in parts per million				
Calcium (Ca)	53	9.2	18	13
Magnesium (Mg)	29	2.4	19	8.0
Sodium (Na)	171	13	151	14
Potassium (K)	7.8	1.2	3.5	1.2
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	146	36	132	73
Sulfate (SO_4)	46	14	33	14
Chloride (Cl)	295	15	269	15
Nitrate (NO_3)	2.7	0.0	0.2	0.0
Fluoride (F)	0.3	0.0	0.2	0.1
Boron (B)	0.80	0.00	0.6	0.0
Silica (SiO_2)	20	8.4	18	17
Total dissolved solids in parts per million	695	85	432	118
Percent sodium	68	31	68	31
Hardness as $CaCO_3$ in parts per million				
Total	269	39	269	65
Noncarbonate	161	0	161	5
Turbidity	125	3	50	11
Coliform in most probable number per milliliter	>7,000.	0.0	7,000.	2.3
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.23	0.	0.76	0.1
Solid alpha	1.57	0.0	0.58	0.22
Dissolved beta	14.2	0.0	1.2	0.7
Solid beta	17.0	0.0	17.0	0.0

WATER QUALITY VARIATIONS



ROCK SLOUGH NEAR KNIGHTSEN (STA. NO. 109)

Cosumnes River Basin

The Cosumnes River watershed lies in the central portion of the Central Valley Region. The basin contains approximately 537 square miles, all of which are classified as mountains and foothills. It is bounded by the drainage divide of the Sierra Nevada Range on the east, by the American River drainage on the north, and by the Mokelumne River drainage on the south. The Cosumnes River flows into the Mokelumne River near Thornton. The Cosumnes River at Michigan Bar has a total estimated mean annual flow of 374,000 acre-feet.

Prominent uses of surface water in the basin include developments devoted to recreation, irrigation, and fish and wildlife propagation and preservation.

Waste discharges entering the waterways of this basin are on an individual basis, small in volume and number, and appear to offer no impairment problems.

The following tabulation presents the names of stations maintained to monitor quality of surface water in this basin and the page on which each is discussed:

Monitoring Station	Page Number of Station Discussion
Cosumnes River at Michigan Bar	358
Cosumnes River at McConnell	360

COSUMNES RIVER AT MICHIGAN BAR (STA. 94)

Sampling Point. Michigan Bar station is located in Section 36, Township 8 North, Range 8 East, Mt. Diablo Base and Meridian. The monthly water samples were collected at mid-channel from the county road bridge, at the USGS gaging station, 5.5 miles southwest of Latrobe and about 12 miles downstream from the confluence of the north and middle forks of the Cosumnes River, in Sacramento County.

Period of Record. July 1952 through December 1961.

Water Quality Characteristics. Past analyses of water at Station 94 show it to be calcium-bicarbonate in character, soft, of excellent mineral quality, and consistently class 1 for irrigation water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	1[illegible]	42.2	120	[illegible]
Temperature in °F	86	[illegible]	84	37
Dissolved oxygen in parts per million	13.2	[illegible]	[illegible]	[illegible]
Percent saturation	132	72	117	[illegible]
pH	8.3	[illegible]	7.9	[illegible]
Mineral constituents in parts per million				
Calcium (Ca)	13	4.0	[illegible]	[illegible]
Magnesium (Mg)	[illegible]	[illegible]	[illegible]	[illegible]
Sodium (Na)	[illegible]	[illegible]	[illegible]	.7
Potassium (K)	1.0	[illegible]	1.1	[illegible]
Carbonate (CO_3)	3	0	0	[illegible]
Bicarbonate (HCO_3)	77	[illegible]	[illegible]	31
Sulfate (SO_4)	12	[illegible]	[illegible]	[illegible]
Chloride (Cl)	[illegible]	[illegible]	[illegible]	[illegible]
Nitrate (NO_3)	1.2	[illegible]	0.1	[illegible]
Fluoride (F)	[illegible]	[illegible]	[illegible]	.1
Boron (B)	[illegible]	[illegible]	[illegible]	[illegible]
Silica (SiO_2)	21	15	19	15
Total dissolved solids in parts per million	[illegible]	[illegible]	[illegible]	43
Percent sodium	27	14	27	14
Hardness as $CaCO_3$ in parts per million				
Total	[illegible]	[illegible]	[illegible]	[illegible]
Noncarbonate	11	0	6	0
Turbidity	300	0.2	15	1
Coliform in most probable number per milliliter	[illegible],100.	0.06	[illegible],100.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.32	0.00	0.0	[illegible]
Solid alpha	[illegible]	[illegible]	[illegible]	[illegible]
Dissolved beta	6.06	[illegible]	[illegible]	[illegible]
Solid beta	[illegible]	[illegible]	[illegible]	[illegible]

WATER QUALITY VARIATIONS

COSUMNES RIVER AT MICHIGAN BAR (STA. NO. 94)

COSUMNES RIVER AT McCONNELL (STA. 94a)

Sampling Point. Station 94a is located in Section 20, Township 6 North, Range 6 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from mid-channel from U. S. Highway 99 bridge, at the USGS gaging station located approximately 7.7 miles north of Galt, Sacramento County.

Period of Record. July 1958 through December 1961. The Cosumnes River is often dry at this point during the summer and fall months.

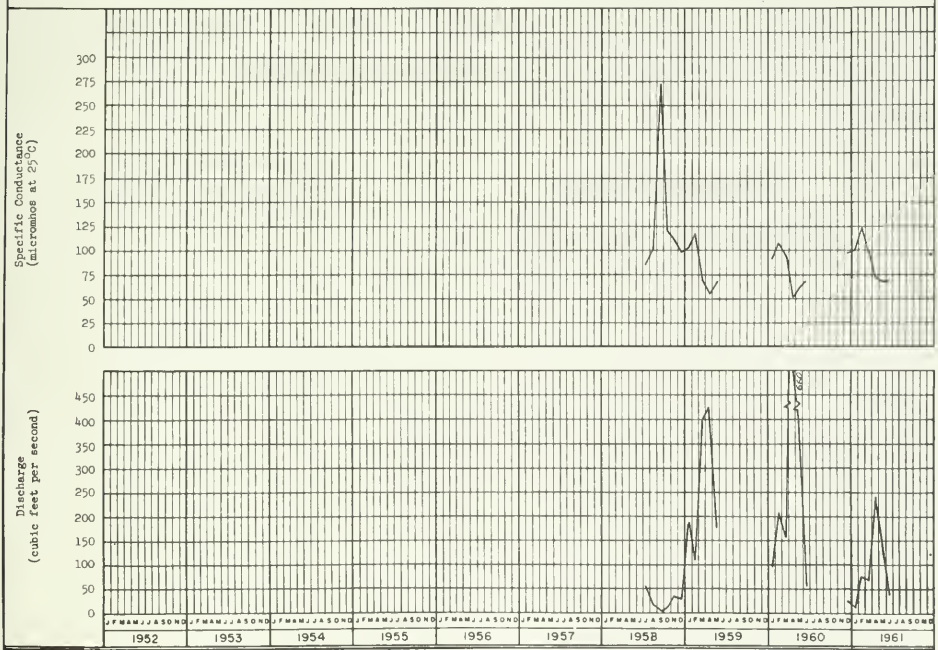
Water Quality Characteristics. Past analyses show the water to be a calcium bicarbonate type, soft, of excellent mineral quality, and consistently within the recommended limits for drinking water.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhoe at 25°C)	276	51.4	124	67
Temperature in °F	86	37	68	37
Dissolved oxygen in parts per million	13.5	7.7	13.5	8.9
Percent saturation	110	86	101	94
pH	8.1	7.0	7.4	7.0
Mineral constituents in parts per million				
Calcium (Ca)	22	5.6	6.0	
Magnesium (Mg)	12	1.9	2.9	
Sodium (Na)	19	2.1	5.0	2.9
Potassium (K)	3.3	0.6	0.9	
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	155	27	54	36
Sulfate (SO_4)	7.3	0.0	2.0	
Chloride (Cl)	6.0	0.5	4.0	1.5
Nitrate (NO_3)	1.7	0.0	0.2	
Fluoride (F)	0.3	0.0	0.1	
Boron (B)	0.2	0.0	0.1	0.0
Silica (SiO_2)	55	16	18	
Total dissolved solids in parts per million	198	38	93	51
Percent sodium	29	14	22	14
Hardness as $CaCO_3$ in parts per million				
Total	98	22	49	27
Noncarbonate	8	0	6	0
Turbidity	70	0	45	2
Coliform in most probable number per milliliter	2,400.	0.23	1,300.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.50	0.00	0.08	
Solid alpha	1.28	0.09	0.42	
Dissolved beta	4.75	0.9	0.4	
Solid beta	7.75	0.21	.4	

WATER QUALITY VARIATIONS



COSUMNES RIVER AT McCONNELL (STA. NO. 94a)

Mokelumne River Basin

The Mokelumne River watershed lies in the central portion of the Central Valley Region. It contains 626 square miles, 622 of which are mountains and foothills. The remainder are valley and mesa lands. The river drains a portion of the western slope of the Sierra Nevada Range. It is bordered by the Cosumnes River drainage on the north, and Calaveras River drainage on the south. The Mokelumne River enters the Delta near Thornton. At Clements, the Mokelumne River has a total estimated mean annual flow of 780,000 acre-feet.

Only about four square miles of the Mokelumne River drainage basin are potential agricultural lands. The most prominent uses of surface water in this basin are for recreation, power development, fish and wildlife propagation and preservation, and export by Mokelumne Aqueduct for municipal use by the East Bay Municipal Utility District.

The following tabulation presents the names of stations maintained to monitor quality of surface water in this basin, and the page on which each is discussed:

Monitoring Station	Page Number of Station Discussion
Mokelumne River near Lancha Plana	364
Mokelumne River at Woodbridge	366

MOKELUMNE RIVER AT LANCHA PLANA (STA. 23a)

Sampling Point. Station 23a is located in Section 4, Township 4 North, Range 10 East, Mt. Diablo Base and Meridian. The monthly grab samples were collected from the left bank, 3.0 miles downstream from Pardee Dam, about 5.0 miles upstream from Camanche Creek, and about 1.0 mile east of Lancha Plana, Calaveras County.

Period of Record. April 1951 through December 1961.

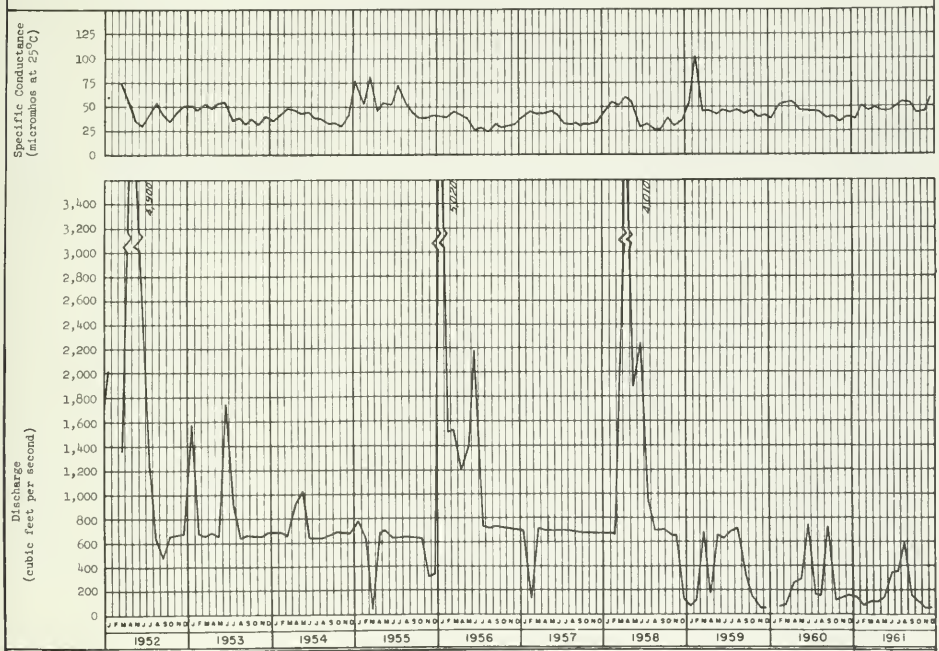
Water Quality Characteristics. Past analyses show the water at this station to be predominantly calcium-bicarbonate in character, soft, consistently class 1 for irrigation, of excellent mineral quality, and suitable for all beneficial uses.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	102	26.6	59	36.6
Temperature in °F	67	43	64	48
Dissolved oxygen in parts per million	13.6	8.8	11.9	9.4
Percent saturation	136	86	107	92
pH	7.8	6.2	7.8	6.2
Mineral constituents in parts per million				
Calcium (Ca)	7.2	2.8	4.6	3.2
Magnesium (Mg)	2.9	0.2	1.9	1.6
Sodium (Na)	5.2	0.7	3.9	1.3
Potassium (K)	2.4	0.2	2.4	0.7
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	31	10	22	11
Sulfate (SO_4)	12	1.0	12	1.0
Chloride (Cl)	6.2	0.0	6.2	1.8
Nitrate (NO_3)	0.7	0.0	0.1	0.0
Fluoride (F)	0.2	0.0	0.2	0.0
Boron (B)	0.35	0.00	0.1	0.0
Silica (SiO_2)	16	6.5	13	10
Total dissolved solids in parts per million	81	21	47	29
Percent sodium	45	13	31	13
Hardness as $CaCO_3$ in parts per million				
Total	38	9	20	14
Noncarbonate	26	0	9	0
Turbidity	90	0	6	1
Coliform in most probable number per milliliter	7,000.	<0.045	620.	0.06
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.28	0.00	0.22	0.0
Solid alpha	1.17	0.00	0.60	0.45
Dissolved beta	3.49	0.00	2.1	1.5
Solid beta	10.52	0.30	3.2	2.0

WATER QUALITY VARIATIONS



MOKELUMNE RIVER NEAR LANCHA PLANA (STA. NO. 23a)

MOKELUMNE RIVER AT WOODBRIDGE (STA. 23)

Sampling Point. Station 23 is located in Section 34, Township 4 North, Range 6 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank at the USGS gaging station, about 0.4 mile downstream from Woodbridge Irrigation District dam in San Joaquin County.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Past analyses show the water to be bicarbonate in character with calcium as the predominant cation. The water is consistently class 1 for irrigation use, soft, and suitable for all beneficial uses.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	87.3	30.2	66	40.5
Temperature in °F	74	43	74	43
Dissolved oxygen in parts per million	13.0	7.3	12.0	7.3
Percent saturation	114	75	111	81
pH	7.8	6.4	7.3	6.6
Mineral constituents in parts per million				
Calcium (Ca)	8.4	2.0	6.4	5.4
Magnesium (Mg)	4.4	0.3	1.6	0.7
Sodium (Na)	4.9	1.4	4.3	2.0
Potassium (K)	1.6	0.4	1.5	0.7
Carbonate (CO_3)	0	0	0	0
Bicarbonate (HCO_3)	37	10	26	15
Sulfate (SO_4)	13	0.0	2.0	1.0
Chloride (Cl)	7.6	0.0	7.0	2.2
Nitrate (NO_3)	2.4	0.0	0.9	0.1
Fluoride (F)	0.3	0.0	0.2	0.0
Boron (B)	0.22	0.00	0.1	0.0
Silica (SiO_2)	15	8.8	12	10
Total dissolved solids in parts per million	73	22	51	31
Percent sodium	36	16	32	19
Hardness as $CaCO_3$ in parts per million				
Total	32	9	24	16
Noncarbonate	14	0	6	0
Turbidity	70	0	11	2
Coliform in most probable number per milliliter	>7,000.	0.62	>7,000.	0.62
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.76	0.00	0.76	0.0
Solid alpha	1.10	0.00	0.91	0.0
Dissolved beta	25.5	0.00	4.0	0.0
Solid beta	14.76	0.00	10.3	4.6

WATER QUALITY VARIATIONS

MOKELUMNE RIVER AT WOODBRIDGE (STA. NO. 23)

Calaveras River Basin

The Calaveras River watershed contains 395 square miles in the central portion of the Central Valley Region. The basin drains the mountainous and foothill terrain along the western slopes of the Sierra Nevada Range.

The Calaveras River parallels the course of the Mokelumne and Stanislaus Rivers, whose basins border it on the north and south, respectively, and flows westward into the San Joaquin River below Stockton. The average seasonal runoff, measured at Jenny Lind, is estimated to be 199,000 acre-feet.

Very unproductive top soil, coupled with a relatively rugged topography, have limited the development in the basin. Mining, livestock raising, and lumbering operations are carried on to a minor degree. Recreational activities have increased in recent years and are playing an increasingly important role in the economy of the basin. The most prominent uses of surface water are for recreation and irrigation.

Waste discharges entering the waterways of this basin are small in volume and number, and have not caused any impairment problem.

The following tabulation presents the names of stations maintained to monitor quality of surface water in this basin, and the page on which each is discussed:

Monitoring Station	Page Number of Station Discussion
Calaveras River at Jenny Lind	370
Calaveras River near Stockton	372

CALAVERAS RIVER AT JENNY LIND (STA. 16a)

Sampling Point. Station 16a is located in Section 27, Township 3 North, Range 10 East, Mt. Diablo Base and Meridian. Samples were collected from the right bank, about 0.2 mile south of Jenny Lind, in Calaveras County.

Period of Record. April 1951 through December 1961.

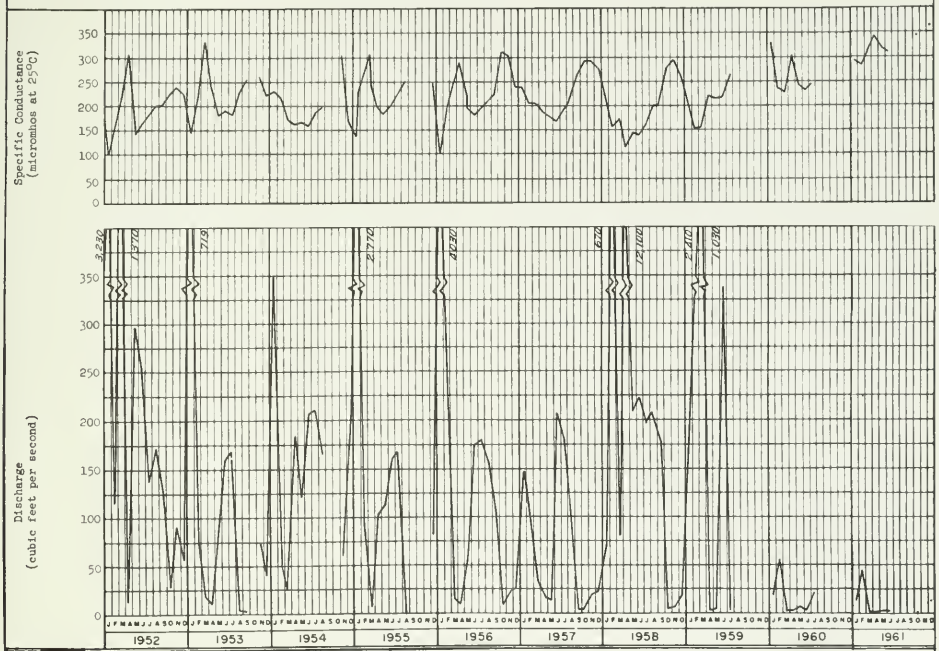
Water Quality Characteristics. Past analyses show the water to be a calcium-bicarbonate type, moderately hard, class 1 for irrigation, and within the recommended limits for drinking water for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	363	111	363	281
Temperature in °F	82	40	73	41
Dissolved oxygen in parts per million	14.0	[illegible]	11.9	7.0
Percent saturation	125	44	114	76
pH	8.3	6.8	7.9	7.2
Mineral constituents in parts per million				
Calcium (Ca)	59	12	35	
Magnesium (Mg)	20	2.9	13	
Sodium (Na)	12	2.4	14	8.4
Potassium (K)	8.0	1.0	2.2	
Carbonate (CO_3)	4	0	3	0
Bicarbonate (HCO_3)	181	44	176	114
Sulfate (SO_4)	26	5.8	26	
Chloride (Cl)	18	0.0	18	9.0
Nitrate (NO_3)	2.2	0.0	0.8	
Fluoride (F)	0.3	0.0	0.1	
Boron (B)	0.0	0.00	0.2	0.0
Silica (SiO_2)	23	13	13	
Total dissolved solids in parts per million	243	62	243	173
Percent sodium	18	11	17	12
Hardness as $CaCO_3$ in parts per million				
Total	159	42	159	120
Noncarbonate	67	0	34	9
Turbidity	160	0	20	1
Coliform in most probable number per milliliter	7,000	<0.045	620.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.42	0.00	0.01	
Solid alpha	1.08	0.00	0.47	
Dissolved beta	9.2	0.0	4.2	
Solid beta	11.5	0.00	4.2	

WATER QUALITY VARIATIONS



CALAVERAS RIVER AT JENNY LIND (STA. NO. 16a)

CALAVERAS RIVER NEAR STOCKTON (STA. 16b)

Sampling Point. The Stockton station is located in Section 26, Township 2 North, Range 6 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected in mid-channel from West Lane bridge.

Period of Record. July 1958 through December 1961. Streamflow has been observed on only eight occasions since the initiation of sampling at this station.

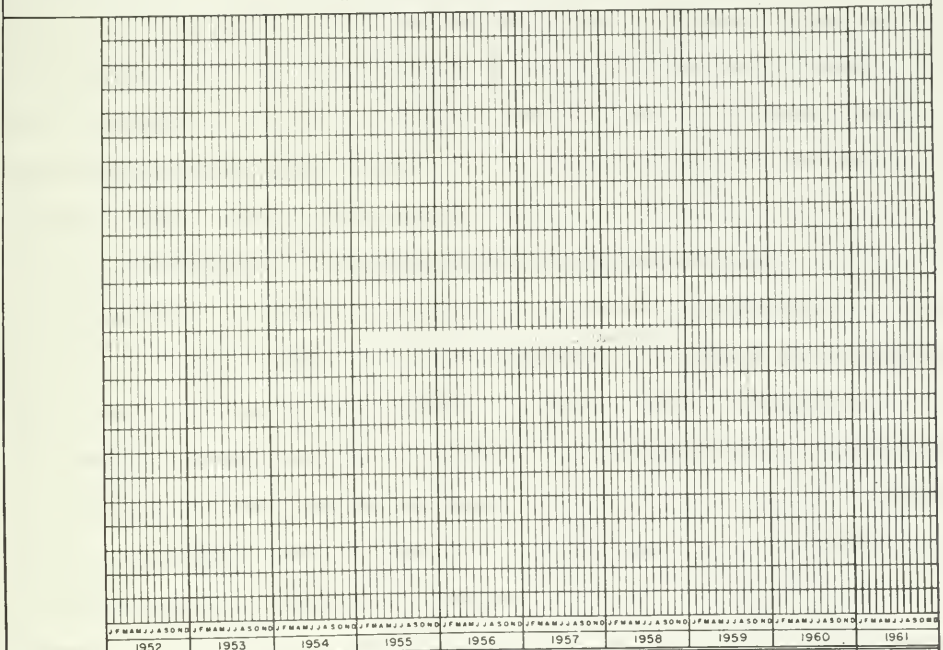
Water Quality Characteristics. Based on limited data, waters of the Calaveras River near Stockton are predominantly calcium-bicarbonate, soft to slightly hard, and of excellent mineral quality for irrigation.

Significant Water Quality Changes. The stream was dry for eight months in 1960, and throughout the entire year of 1961.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	234	135	NOT SAMPLED	
Temperature in °F	79	40		
Dissolved oxygen in parts per million	10.5	4.0		
Percent saturation	114	44		
pH	8.1	7.1		
Mineral constituents in parts per million				
Calcium (Ca)	26	13		
Magnesium (Mg)	9.2	4.7		
Sodium (Na)	8.6	5.0		
Potassium (K)	3.8	1.6		
Carbonate (CO_3)	0	0		
Bicarbonate (HCO_3)	119	60		
Sulfate (SO_4)	20	6.0		
Chloride (Cl)	11	4.0		
Nitrate (NO_3)	2.5	0.0		
Fluoride (F)	0.4	0.0		
Boron (B)	0.3	0.0		
Silica (SiO_2)	31	11		
Total dissolved solids in parts per million	149	94		
Percent sodium	21	11		
Hardness as $CaCO_3$ in parts per million				
Total	101	52		
Noncarbonate	16	0		
Turbidity	30	1		
Coliform in most probable number per milliliter	>7,000.	13.		
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.24	0.16		
Solid alpha	0.47	0.08		
Dissolved beta	3.5	2.53		
Solid beta	4.59	0.0		

WATER QUALITY VARIATIONS



CALAVERAS RIVER NEAR STOCKTON (STA. NO. 16b)

Tulare Lake Subregion (5d)

Tulare Lake Subregion encompasses the southern one-third of the Great Central Valley as well as the mountainous drainage area coterminous to the valley on three sides. The subregion extends approximately 130 miles southerly from the San Joaquin River to the drainage divide of the Tehachapi Mountains. Average width of the basin is 120 miles with the eastern boundary defined by the crest of the Sierra Nevada, and the western boundary by the drainage divide along the coastal ranges. The Tulare Lake Subregion encompasses an area of more than 16,000 square miles, of which nearly 8,000 square miles is valley and mesa area and the other half is mountain and foothill area.

The valley portion of Tulare Lake Subregion consists of relatively flat-bottomed terrain bordered on three sides by gently sloping alluvial fans. Lowlands of the valley floor range in elevation from 220 feet above sea level at Tulare Lake to an elevation of about 500 feet along the southern end. The valley floor is broken by several ridges, such as Kettleman Hills and Elk Hills, which have crest elevations of over 1,000 feet. Stream systems in this basin are tributary to shallow sumps in the trough of the valley, chiefly Tulare and Buena Vista Lake beds. In the historic past, however, during years of heavy floods, the low divide between Buena Vista and Tulare Lakes, and between Tulare Lake and San Joaquin River drainage were overtopped. During such periods, surface runoff flowed out of the Tulare Lake Subregion into the San Joaquin River.

Mountainous terrain, bounding the three sides of the valley area, rise from the valley floor as gently rolling foothills, grading upwards to rugged mountainous terrain. The Sierra Nevada Range on the east rises to altitudes greater than 14,000 feet, dominated by Mt. Whitney; the Coast Ranges to the west rise to 6,000 feet; and to the south, the valley is enclosed by the coastal and Tehachapi Mountains, which rise to altitudes of about 8,000 feet.

Natural mean seasonal surface runoff for the basin is estimated to be in excess of 3,300,000 acre-feet. Principal hydrographic units are the Kings, Kern, Kaweah, and Tule Rivers, all originating in the Sierra Nevada. Flows are sustained by the Sierra Nevada seasonal snowpack. No streams of importance enter the valley area from the Coast Ranges or the Tehachapi Mountains. Monitored streams, with the number of stations in parentheses, are as follows:

Kings River (4)
Kern River (3)
Kaweah River (1)
Tule River (1)

Kings River Basin

Kings River Basin is located in the Sierra Nevada in Fresno and Tulare Counties. The basin encompasses an area of more than 7,000 square miles, classified as mountainous foothill terrain, and about 160 square miles classified as valley and mesa land. It is bounded on the north by the San Joaquin River drainage divide, on the east by the crest of the Sierra Nevada, on the south by the Kaweah River drainage basin, and on the west by the Tulare Lake bed. During high flows, runoff from Kings River overflows to the San Joaquin River via Fresno Slough.

The Middle and Main South Forks of Kings River originate near the Sierra crest line at an altitude in excess of 10,000 feet. From their headwaters, these streams flow eastward through Kings Canyon National Park where terrain is extremely rugged and mountainous with deeply entrenched steep-walled canyons. The mountainous area slowly gives way to a moderately rugged foothill terrain at Piedra. Kings River flows into the San Joaquin Valley at an elevation of 500 feet above sea level and terminates in Tulare Lake at an elevation of 200 feet above sea level. Total average annual runoff in the Kings River is about 1,700,000 acre-feet.

In the upper reaches of the Kings River (Kings Canyon National Park), recreation is the primary activity. Lumbering, ranching, recreation, and hydroelectric power developments are the chief industries between the park and the base of the foothills.

Waste discharges entering the waterways of Kings River basin above the foothill line are quantitatively negligible. Impairment of the mineral quality of runoff by these waste discharges has not caused a discernible problem.

Big Creek above Pine Flat Dam (Sta. 33d) was added to the program effective July 1, 1960. This station was established to monitor the water emitting

from the multiple use demonstration forest established by the United States Forest Service in the Big Creek drainage basin which is in the Kings River Basin.

The following tabulation lists the stations maintained to monitor quality of surface water in this basin and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Kings River below North Fork	378
Kings River below Pine Flat Dam	380
Kings River below Peoples Weir	382
Big Creek above Pine Flat Dam	384

KINGS RIVER BELOW NORTH FORK (STA. 33c)

Sampling Point. Station 33c on Kings River is located in Section 21, Township 12 South, Range 26 East, Mt. Diablo Base and Meridian, in Fresno County. Monthly grab samples were collected at mid-stream, from the highway bridge located 0.8 mile downstream from the North Fork confluence.

Period of Record. September 1955 through December 1961.

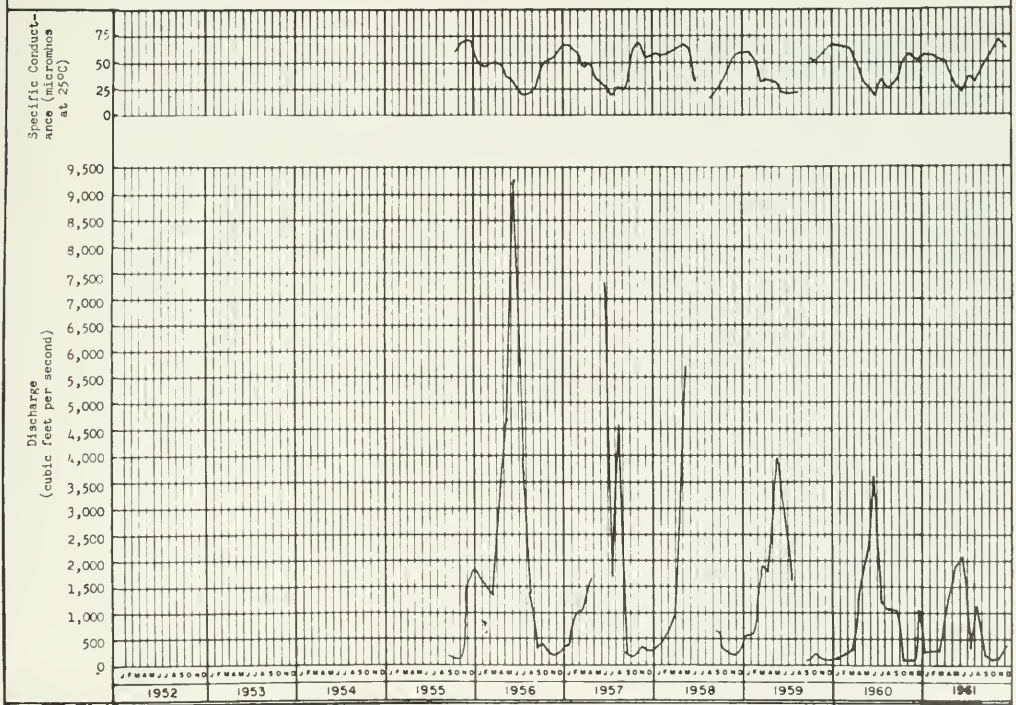
Water Quality Characteristics. The Kings River at Station 33c is characterized by nearly equivalent calcium, magnesium, and sodium cations, and of the anions, bicarbonate is predominant. The mineral quality of the water is excellent, class 1 for irrigation, suitable for drinking water, and soft with a maximum recorded hardness of 28 ppm. Quality of Kings River at this station is representative of the major portion of inflow to Pine Flat Reservoir.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	71.7	16.8	70	23
Temperature in °F	74	37	74	37
Dissolved oxygen in parts per million	18.0	7.1	10.8	8.0
Percent saturation	181	74	118	74
pH	7.7	6.4	7.6	6.8
Mineral constituents in parts per million				
Calcium (Ca)	8.0	1.6	5.3	2.1
Magnesium (Mg)	1.2	0.0	0.7	0.4
Sodium (Na)	5.7	1.0	5.3	1.5
Potassium (K)	1.5	0.2	0.9	0.6
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	33	7	31	10
Sulfate (SO_4)	6.7	0.0	2.0	1.0
Chloride (Cl)	5.2	0.0	3.5	0.2
Nitrate (NO_3)	2.1	0.0	0.2	0.1
Fluoride (F)	0.3	0.0	0.2	0.0
Boron (B)	0.15	0.0	0.1	0.0
Silica (SiO_2)	12	1.7	7.6	6.8
Total dissolved solids in parts per million	52	12	50	17
Percent sodium	39	19	35	23
Hardness as $CaCO_3$ in parts per million				
Total	28	6	24	8
Noncarbonate	5	0.0	4	0.0
Turbidity	45	0.0	5	1
Coliform in most probable number per milliliter	7,000.	0.045	500.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.41	0.00	0.41	0.0
Solid alpha	0.97	0.00	0.41	0.0
Dissolved beta	19.47	0.00	2.2	1.6
Solid beta	12.2	0.00	12.2	0.0

WATER QUALITY VARIATIONS



KINGS RIVER BELOW NORTH FORK (STA. NO. 33c)

KINGS RIVER BELOW PINE FLAT DAM (STA. 33b)

Sampling Point. Pine Flat Dam station is located in Section 2, Township 13 South, Range 24 East, Mt. Diablo Base and Meridian, Fresno County. Monthly grab samples were collected from the left bank, at the bridge located about 3,000 feet downstream from Pine Flat Dam.

Period of Record. September 1955 through December 1961.

Water Quality Characteristics. Kings River below Pine Flat Dam is calcium bicarbonate or occasionally a calcium-sodium bicarbonate type water. The water is class 1 for irrigation, meets the criteria for domestic use, and is soft (maximum recorded hardness of 24 ppm). Mineral quality at this station is qualitatively similar to that at Station 33c (Kings River below North Fork) located about 25 miles upstream.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	62.9	18.8	57	28
Temperature in °F	75	45	73	50
Dissolved oxygen in parts per million	13.0	7.8	10.7	9.9
Percent saturation	140	80	121	92
pH	7.8	4.7	7.8	6.8
Mineral constituents in parts per million				
Calcium (Ca)	6.6	2.6	5.8	3.8
Magnesium (Mg)	1.6	0.C	1.5	0.6
Sodium (Na)	3.9	1.C	3.9	1.6
Potassium (K)	2.1	0.4	0.9	0.6
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	32	1	27	15
Sulfate (SO_4)	5.8	0.0	2.8	0.6
Chloride (Cl)	7.2	0.0	5.5	0.1
Nitrate (NO_3)	1.2	0.0	0.6	0.3
Fluoride (F)	0.2	0.0	0.4	0.0
Boron (B)	0.2	0.0	0.2	0.0
Silica (SiO_2)	14	2.4	8.2	7.2
Total dissolved solids in parts per million	46	14	42	22
Percent sodium	39	12	35	17
Hardness as $CaCO_3$ in parts per million				
Total	28	6	24	10
Noncarbonate	11	0.0	5	0.0
Turbidity	230	0.3	10	1
Coliform in most probable number per milliliter	7,000.	0.045	7,000.	0.045
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.53	0.00	0.08	0.0
Solid alpha	1.07	0.00	0.15	0.0
Dissolved beta	8.4	0.00	8.4	5.3
Solid beta	7.4	1.4	7.4	1.4

WATER QUALITY VARIATIONS

KINGS RIVER BELOW PINE FLAT DAM (STA. NO. 33b)

KINGS RIVER BELOW PEOPLES WEIR (STA. 34)

Sampling Point. Station 34 is situated in Section 1, Township 17 South, Range 22 East, Mt. Diablo Base and Meridian, in Kings County. The monthly grab samples were collected from the left bank, at the stream gage located about one-fourth mile downstream from the diversion weir, approximately 2 miles south of Kingsburg and 12 miles northeast of Hanford.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Water from Station 34 has bicarbonate as the predominate anion with no specific cation predominate. Qualitatively, the water is excellent, ranges from soft to moderately hard, and meets class 1 irrigation criteria. For those constituents tested, these waters also meet mineral standards for drinking water. Concentrations of mineral constituents in Kings River at Station 34 are considerably higher (over 100 percent or about 60 micromhos) than at the upstream Station 33b below Pine Flat Dam. The large differential between these two stations occurs during winter and spring months, and is attributable to the natural leaching of soils and rocks of the watershed.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	276	27	214	36
Temperature in °F	85	41	75	43
Dissolved oxygen in parts per million	15.0	4.7	11.9	6.1
Percent saturation	117	63	116	68
pH	8.1	5.9	8.1	7.1
Mineral constituents in parts per million				
Calcium (Ca)	25	3.0	13	6.2
Magnesium (Mg)	8.7	0.0	4.4	2.1
Sodium (Na)	24	1.5	13	2.0
Potassium (K)	3.8	0.5	1.3	1.3
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	139	8	114	18
Sulfate (SO_4)	14	0.0	7.0	0.6
Chloride (Cl)	16	0.0	6.8	0.6
Nitrate (NO_3)	6.2	0.0	0.9	0.3
Fluoride (F)	0.3	0.0	0.2	0.0
Boron (B)	0.32	0.0	0.1	0.0
Silica (SiO_2)	26	5.7	13	9.7
Total dissolved solids in parts per million	190	19	147	25
Percent sodium	45	18	30	18
Hardness as $CaCO_3$ in parts per million	97	10	79	13
Total	6	0.0	1	0
Noncarbonate				
Turbidity	65	0.0	10	1
Coliform in most probable number per milliliter	7,000.	0.06	2,400.	0.06
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.68	0.00	0.41	0.0
Solid alpha	1.02	0.00	0.16	0.0
Dissolved beta	18.9	0.00	5.5	4.4
Solid beta	9.9	0.00	6.3	0.0

WATER QUALITY VARIATIONS

KINGS RIVER BELOW PEOPLES WEIR (STA. NO. 34)

BIG CREEK ABOVE PINE FLAT DAM (STA. 33d)

Sampling Point. Station 33d is located in Section 4 of Township 12 South, Range 25 East, Mt. Diablo Base and Meridian, in Fresno County. Monthly grab samples were collected from the right bank about 150 feet downstream from the USGS gaging station, 2.7 miles northeast of Trimmer.

Period of Record. July 1960 through December 1961.

Water Quality Characteristics. Water at this station is excellent in mineral quality, soft, and suitable for all beneficial uses.

Significant Water Quality Changes. None.

Kaweah River Basin

Kaweah River basin is located in the Sierra Nevada east of Visalia and extends from Sequoia National Park to Three Rivers in Tulare County. The basin encompasses an area of about 500 square miles of mountainous and hilly terrain and is bounded on the north and northeast by the Kings River watershed, on the east and southeast by the Kern River drainage divide, and on the south by the Tule River drainage area. Kaweah River flows into the San Joaquin Valley at Lemon Cove where the channel splits into several distributaries eventually draining into Tulare Lake, which acts as a terminal reservoir or sump.

Forks of the Kaweah River head in an extremely rugged mountainous area with alpine peaks rising above 10,000 feet. Steep walled canyons and ravines are characteristic of the waterways in the upper reaches. Progressing downslope, the topography undergoes a gradual transition to rolling foothills and broader river valleys. Kaweah River flows out of the hydrographic unit at Three Rivers at an elevation of 800 feet above sea level. Total average annual runoff of the Kaweah River Basin is about 400,000 acre-feet.

Economic activities in Kaweah River Basin consist primarily of recreation, ranching, hydroelectric power development, and lumbering. Approximately seven miles downstream from Three Rivers, near Lemon Cove, Terminus Dam was under construction during 1961 by the U. S. Corps of Engineers. The structure was completed by December of that year and will provide flood control, irrigation, and other benefits to nearby areas.

Numerous domestic wastes are discharged into the waterways of this basin; however, these are comparatively minor quantitatively and have created no noticeable impairment of mineral quality.

A surface water sampling station is maintained on Kaweah River near Three Rivers to monitor quality of runoff from the basin. A discussion of records at this station is presented on the following page.

KAWEAH RIVER BELOW TERMINOUS DAM (STA. 35)

Sampling Point. In December 1961, it was necessary to relocate and rename Station 35 due to completion of Terminous Dam. The new location is in Section 26, Township 17 South, Range 28 East, Mt. Diablo Base and Meridian, in Tulare County. Monthly grab samples were collected from the left bank, about 1,000 feet downstream from the dam, and 1.5 miles southwest of Three Rivers.

Period of Record. April 1951 through December 1961.

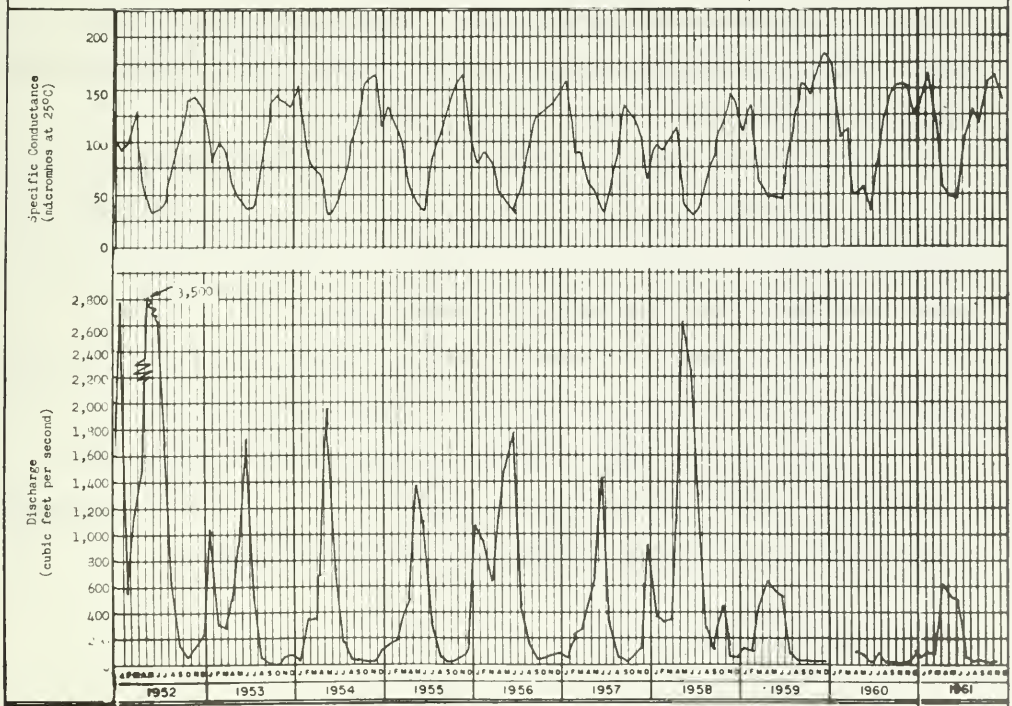
Water Quality Characteristics. Water in Kaweah River at Station 35 is a calcium bicarbonate type. The water has been of excellent mineral quality, soft to moderately hard, class 1 for irrigation, and, for those constituents tested, meets drinking water standards.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	184	27	166	46
Temperature in °F	82	40	81	42
Dissolved oxygen in parts per million	15.5	7.8	12.7	8.1
Percent saturation	134	81	124	78
pH	8.4	6.1	8.4	7.4
Mineral constituents in parts per million				
Calcium (Ca)	20	3.6	16	5.8
Magnesium (Mg)	3.9	0.1	1.5	0.7
Sodium (Na)	16	1.2	10	2.1
Potassium (K)	4.8	0.4	1.6	0.6
Carbonate (CO_3)	4	0.0	2	0.0
Bicarbonate (HCO_3)	88	10	86	23
Sulfate (SO_4)	11	0.0	2.8	1.0
Chloride (Cl)	15	0.0	10	1.3
Nitrate (NO_3)	1.6	0.0	2.5	0.2
Fluoride (F)	0.3	0.0	0.2	0.0
Boron (B)	0.56	0.0	0.2	0.0
Silica (SiO_2)	27	6.2	8.0	7.9
Total dissolved solids in parts per million	122	21	110	30
Percent sodium	43	16	27	17
Hardness as $CaCO_3$ in parts per million				
Total	69	10	69	18
Noncarbonate	9	0.0	4	0.0
Turbidity	170	0.0	10	1
Coliform in most probable number per milliliter	7,000.	0.045	230.	0.06
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.64	0.00	0.20	0.00
Solid alpha	1.2	0.00	0.35	0.00
Dissolved beta	20.43	0.00	3.8	0.00
Solid beta	21.7	0.00	10.6	0.1

WATER QUALITY VARIATIONS



KAWEAH RIVER BELOW TERMINOUS DAM (STA. NO. 35)

Tule River Basin

Tule River Basin is located on the eastern slopes of the Sierra Nevada in the southern part of the Central Valley Region. The basin extends from the southern boundary of Sequoia National Park to Porterville in Tulare County and encompasses an area of about 400 square miles. It is bounded on the north by Kaweah River drainage divide, on the east by Kern River watershed crest line, on the south by the drainage divide of Deer Creek, and on the west by the San Joaquin Valley. Tule River flows westward into the San Joaquin Valley and terminates at Tulare Lake.

Terrain along the upper reaches of Tule River basin is extremely rugged with mountainous ridges rising to altitudes greater than 7,000 feet, and is cut by steep-walled canyons and ravines. Progressing toward the San Joaquin Valley, the topography gradually changes to foothills intervened by relatively broad river valleys. At an elevation of about 500 feet, the Tule River flows out of the Sierra foothills into the San Joaquin Valley at Porterville. The average annual runoff of the Tule River is about 140,000 acre-feet.

Activities in Tule River Basin include recreation, ranching, hydroelectric power development, and limited lumbering and farming (orchards). The newly constructed Success Dam on the Tule River, four miles east of Porterville, provides flood control and other benefits to nearby areas.

Waste discharges are relatively minor in quantity and have not created any deleterious effects on mineral quality of water in the basin.

A surface water sampling station is maintained on Tule River near Porterville to monitor quality of runoff from this basin. A discussion of quality observations at this station is presented on the following page.

TULE RIVER BELOW SUCCESS DAM (STA. 91)

Sampling Point. In September 1959, it was necessary to relocate Station 91 due to construction of Success Dam. The new location is in Section 3, Township 22 South, Range 28 East, Mt. Diablo Base and Meridian, in Tulare County. In December 1961, the station was renamed. Monthly water samples were collected at midstream, from Worth Bridge, about 3 miles downstream from the location of the former sampling station.

Period of Record. July 1952 through December 1961.

Water Quality Characteristics. Water in the Tule River at Station 91 is a calcium bicarbonate type. Mineral quality of the water is excellent and meets class 1 irrigation requirements, and, for those constituents tested, it also meets drinking water standards. Tule River waters range from soft to very hard with the hardness attributable to the natural leaching of soils and rocks of the watershed.

Significant Water Quality Changes. From the accompanying graph, it can be seen that the minimum values for specific conductance during the three year period, 1959-61, are significantly higher than during period of record before 1959. This trend toward increased concentration is probably attributable to the lack of diluting flows from snowmelt during this dry period.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	500	90.1	441	269
Temperature in °F	82	43	75	46
Dissolved oxygen in parts per million	13.4	6.3	12.8	9.1
Percent saturation	147	69	118	95
pH	8.4	7.0	8.4	7.9
Mineral constituents in parts per million				
Calcium (Ca)	59	12	38	
Magnesium (Mg)	22	1.2	8.0	
Sodium (Na)	31	4.4	31	15
Potassium (K)	5.0	1.1	2.5	
Carbonate (CO_3)	13	0.0	7.0	4.0
Bicarbonate (HCO_3)	284	48	234	149
Sulfate (SO_4)	7.7	1.0	11.0	7.0
Chloride (Cl)	20	2.0	18	9
Nitrate (NO_3)	0.6	0.0	0.3	
Fluoride (F)	0.2	0.0	0.2	
Boron (B)	0.22	0.0	0.2	0.1
Silica (SiO_2)	35	16	26	
Total dissolved solids in parts per million	328	66	289	176
Percent sodium	28	18	29	22
Hardness as $CaCO_3$ in parts per million				
Total	210	35	180	113
Noncarbonate	0.0	0.0	0.0	0.0
Turbidity	2,000	0.0	30	3
Coliform in most probable number per milliliter	2,400.	0.13	2,400.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha			0.0	
Solid alpha			0.23	
Dissolved beta			6.0	
Solid beta			5.3	

WATER QUALITY VARIATIONS

TULE RIVER BELOW SUCCESS DAM (STA. NO. 91)

Kern River Basin

Kern River basin is located on the southwestern slope of the Sierra Nevada in Tulare and Kern Counties. The basin extends southwesterly from Sequoia National Park near Mt. Whitney to Bakersfield, and encompasses an area of about 2,400 square miles, almost all in mountainous and hilly topography. It is bounded on the northwest by watersheds of the Kaweah and Tule Rivers and other minor streams draining into San Joaquin Valley, on the east and southeast by the Sierra Nevada crest line dominated by Mt. Whitney, and on the south and west by the Tehachapi and Coast Ranges. Emerging from the foothills and into the valley area at Bakersfield, Kern River flows down a gently sloping alluvial fan to Buena Vista Lake.

Above the confluence of North Fork and South Fork of Kern River at Isabella Reservoir, the watershed is extremely rugged and rises to altitudes of about 13,000 feet. Deep, steep-walled canyons have been carved into the mountainous terrain by the Kern River. Below Isabella Reservoir, the topography is moderately rugged grading to rolling foothills toward the edge of the San Joaquin Valley. Total average annual runoff in the Kern River is about 700,000 acre-feet.

The headwater area of the Kern River in Sequoia National Park is generally inaccessible, and hence, activity consists of limited recreation. Below the park, in the foothills, activity consists chiefly of lumbering, ranching, hydroelectric power development, and recreation. Farming and crude oil production are the chief industries in the valley area. Isabella Dam, located about 22 miles northeast of Bakersfield on the Kern River, provides flood control and other benefits to the basin.

Waste waters produced from the Kern River Oil Field, located just north of the Bakersfield city limits, are discharged into the Kern River. Monthly samples do not indicate any significant change in mineral quality as a result of

these waste discharges. Other waste discharges in the watershed are extremely small above the valley floor and have caused no impairment problems.

The following tabulation lists the stations maintained to monitor quality of surface water in this basin and indicates the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Kern River near Kernville	396
Kern River below Isabella Dam	398
Kern River near Bakersfield	400

KERN RIVER NEAR KERNVILLE (STA. 36b)

Sampling Point. Kernville station is located in Section 14, Township 23 South, Range 32 East, Mt. Diablo Base and Meridian, in Tulare County. Monthly grab samples were collected from the right bank, at the USGS stream gaging station, about 3 miles upstream from the confluence with Salmon Creek, and 15 miles north of Kernville.

Period of Record. September 1955 through December 1961.

Water Quality Characteristics. Kern River at Station 36b is characterized by a calcium-sodium bicarbonate type water which is soft and relatively low in dissolved solids. The mineral quality of this water consistently meets the criteria for a class 1 irrigation supply.

Significant Water Quality Changes. The graph on the adjacent page depicts an increasing trend in the concentration of minerals (as measured by specific conductance) in waters at this station beginning in 1959. The increase can be attributed to the lack of diluting waters supplied through snowmelt which, during the dry years 1959-1961, was considerably curtailed. Irrespective of these increases, the concentrations found were well within the criteria established for all beneficial uses.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	204	36.9	204	80
Temperature in °F	72	35	69	36
Dissolved oxygen in parts per million	12.5	7.7	12.4	7.7
Percent saturation	103	81	92	82
pH	8.0	6.7	7.9	7.1
Mineral constituents in parts per million				
Calcium (Ca)	15	4.5	11	6.6
Magnesium (Mg)	3.9	0.1	1.8	1.3
Sodium (Na)	21	2.7	21	8.0
Potassium (K)	1.9	0.5	1.5	1.1
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	98	18	98	34
Sulfate (SO_4)	12	2.9	9.4	2.9
Chloride (Cl)	12	0.2	0.0	0.0
Nitrate (NO_3)	0.4	0.0	0.0	0.0
Fluoride (F)	0.3	0.0	0.3	0.0
Boron (B)	0.8	0.0	0.3	0.0
Silica (SiO_2)	21	13	14	13
Total dissolved solids in parts per million	142	26	142	56
Percent sodium	53	29	48	33
Hardness as $CaCO_3$ in parts per million				
Total	58	11	54	23
Noncarbonate	0.0	0.0	0.0	0.0
Turbidity	85	0.1	85	1
Coliform in most probable number per milliliter	7,000.	0.06	620.	0.23
Radioactivity in micro-micro curies per liter				
Dissolved alpha	0.61	0.00	0.61	0.0
Solid alpha	1.02	0.00	0.46	0.38
Dissolved beta	21.7	0.00	5.0	1.0
Solid beta	16.4	0.00	16.4	6.7

WATER QUALITY VARIATIONS

KERN RIVER NEAR KERNVILLE (STA. NO. 36b)

KERN RIVER BELOW ISABELLA DAM (STA. 36a)

Sampling Point. Station 36a is located in Section 30, Township 26 South, Range 33 East, Mt. Diablo Base and Meridian, in Kern County. Monthly water samples were collected from the right bank, 500 feet downstream from the outfall tunnel of Isabella Dam.

Period of Record. September 1955 through December 1961.

Water Quality Characteristics. Water at Isabella Dam station is consistently a bicarbonate type with either calcium or calcium-sodium cations being predominant. Mineral quality of the water is excellent, soft to moderately hard, and meets the criteria for class 1 irrigation use. Comparison of analyses of samples from Kern River at Station 36a with those from Station 36b, located about ten miles upstream and above Isabella Reservoir, shows that in this reach there is an increase in specific conductance of about 100 micromhos. The reason for this increase has not as yet been determined, although it is probably attributable to the concentration of minerals caused by evaporation from Isabella Reservoir.

Significant Water Quality Changes. As at the station upstream from Isabella Reservoir (36b), mineral concentration at this station followed an increasing trend beginning in 1959. Maximum values of record for many constituents were recorded in 1961. These increases again are attributable to the lack of diluting flows supplied by snowmelt which was considerably reduced during the dry years 1959-1961. However, beneficial use of these waters was in no way restricted by these increases.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	375	66.4	375	254
Temperature in °F	73	38	73	46
Dissolved oxygen in parts per million	10.8	6.1	10.8	6.1
Percent saturation	110	70	91	70
pH	8.4	6.8	8.4	7.0
Mineral constituents in parts per million				
Calcium (Ca)	29	7.6	28	24
Magnesium (Mg)	5.5	0.3	5.5	4.9
Sodium (Na)	36	5.0	36	25
Potassium (K)	4.0	1.1	3.1	2.7
Carbonate (CO_3)	0.0	0.0	3.0	0.0
Bicarbonate (HCO_3)	184	33	184	119
Sulfate (SO_4)	22	0.9	22	15
Chloride (Cl)	17	0.7	17	9.5
Nitrate (NO_3)	2.6	0.0	0.9	0.3
Fluoride (F)	0.5	0.0	0.5	0.0
Boron (B)	0.32	0.0	0.5	0.0
Silica (SiO_2)	17	4.3	16	2.9
Total dissolved solids in parts per million	237	42	237	160
Percent sodium	44	28	44	38
Hardness as $CaCO_3$ in parts per million	115	21	115	73
Total	0.0	0.0	0	0
Noncarbonate				
Turbidity	40	0.6	7	3
Coliform in most probable number per milliliter	7,000.	0.045	620	0.045
Radioactivity in micro-micro curies per liter				
Dissolved alpha	1.78	0.00	1.78	1.06
Solid alpha	1.15	0.00	0.68	0.0
Dissolved beta	14.1	0.00	10.6	6.8
Solid beta	8.11	0.00	5.5	0.0

WATER QUALITY VARIATIONS

KERN RIVER BELOW ISABELLA DAM (STA. NO. 36a)

KERN RIVER NEAR BAKERSFIELD (STA. 36)

Sampling Point. Station 36 on Kern River is located in Section 2, Township 28 South, Range 28 East, Mt. Diablo Base and Meridian, in Kern County. Monthly composite grab samples were collected at this station. Each sample was composited from portions of three samples collected at quarter points on the cross section of the river below the diversion weir located at the mouth of Lower Canyon, five miles northeast of Bakersfield.

Period of Record. April 1951 through December 1961.

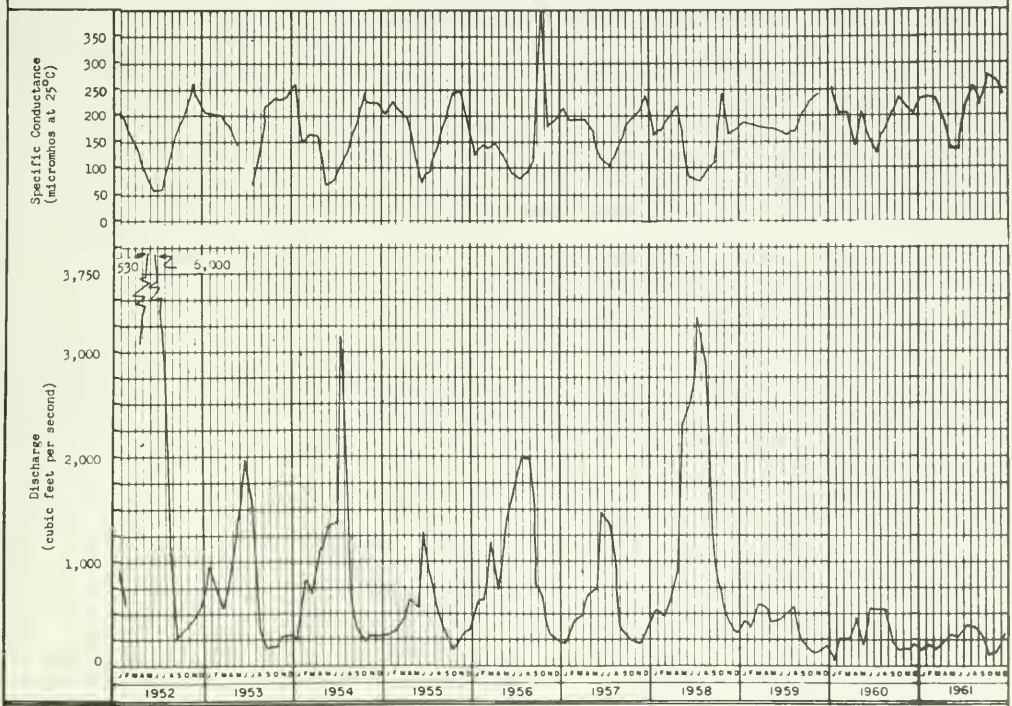
Water Quality Characteristics. A predominance of the bicarbonate anion is characteristic of water from the station; however, the principal cations, calcium and sodium, are nearly equivalent. The water is excellent in quality, soft to moderately hard, and is class 1 for irrigation. Mineral concentrations have increased (as much as 150 micromhos) in Kern River near Bakersfield when compared with quality of flow at the upstream stations near Kernville (Sta. 36b) and below Isabella Dam (Sta. 36a). Increases in most mineral constituents is probably attributable to leaching or drainage of waters from geological formations along this reach of Kern River.

Significant Water Quality Changes. While a trend toward increased mineral concentration similar to that found at the upstream stations (36a and 36b) was evident at the Bakersfield station also, the effect was not nearly so pronounced. A maximum value of record for the principal anion, bicarbonate, was registered in 1961; however, no new maximums were found for any other constituent or property.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	400	63	277	137
Temperature in °F	84	38	78	41
Dissolved oxygen in parts per million	15.5	6.9	12.6	6.9
Percent saturation	147	79	118	79
pH	8.3	6.6	8.1	7.5
Mineral constituents in parts per million				
Calcium (Ca)	64	6.6	19	12
Magnesium (Mg)	7.9	0.7	3.2	1.9
Sodium (Na)	34	5.6	28	13
Potassium (K)	3.2	0.8	2.4	1.3
Carbonate (CO_3)	0.0	0.0	0.0	0.0
Bicarbonate (HCO_3)	125	16	125	54
Sulfate (SO_4)	33	0.0	14	12
Chloride (Cl)	22	1.0	14	5.2
Nitrate (NO_3)	3.2	0.0	0.2	0.0
Fluoride (F)	0.5	0.0	0.4	0.0
Boron (B)	0.46	0.0	0.3	0.1
Silica (SiO_2)	26	0.8	14	13
Total dissolved solids in parts per million	257	40	178	87
Percent sodium	53	14	47	42
Hardness as $CaCO_3$ in parts per million				
Total	168	19	77	38
Noncarbonate	107	0.0	0	0
Turbidity	350	0.0	20	2
Coliform in most probable number per millilitar	7,000.	0.045	620.	0.045
Radioactivity in micro-micro curies per liter				
Dissolved alpha	2.15	0.00	1.30	0.78
Solid alpha	1.02	0.00	0.80	0.52
Dissolved beta	12.1	0.00	8.4	1.0
Solid beta	13.98	0.00	4.0	1.3

WATER QUALITY VARIATIONS



KERN RIVER NEAR BAKERSFIELD (STA. NO. 36)

Lahontan Region (No. 6)

The Lahontan Region extends from the Oregon border on the north, to the southern boundary of the Mojave River Basin on the south, and comprises that area situated between the California-Nevada border to the east and the Sierra Nevada to the west. The region contains about 33,000 square miles and varies in width from less than 20 miles in the north to over 170 miles, across the Mojave Desert and Antelope Valley, in the south.

The terrain of the region is characterized by basins of interior drainage or sinks surrounded by mountain peaks. Areas classified as valley and mesa lands cover about 10,000 square miles, most of which are considered irrigable. The eastern slopes of the Sierra Nevada dominate the mountainous portions of the Lahontan Region.

The region has an estimated mean seasonal runoff of 3,177,000 acre-feet. Principal streams in the Lahontan area include the Susan, Truckee, Carson, Walker, Owens, and Mojave Rivers. To provide a continuing check on the quality of surface runoff in this region, 12 sampling stations are maintained on the following surface water sources as indicated in the following tabulation. The number of sampling stations on each source is shown in parentheses.

Susan River (1)	Carson River (2)
Truckee River (5)	Walker River (2)
	Mojave (2)*

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* The Mojave River is in Southern California and will be discussed in Volume II of this bulletin.

Susan River Basin

Susan River Basin is a subbasin in the closed Honey Lake Basin located in the northeastern portion of California. The river originates on the slopes of the Sierra Nevada and flows eastward into Honey Lake Valley. Susan River watershed contains about 238 square miles and has an estimated mean seasonal runoff of 50,900 acre-feet.

Timber covered mountains and foothills comprise 157 square miles in the basin. Valley and mesa lands, some of which are also heavily forested, cover the remaining 81 square miles of watershed tributary to Susan River. Lumbering is the primary industry, followed in importance by the beef industry and agriculture devoted to the support of livestock.

Waste discharges in the Susan River Basin are primarily those associated with lumbermills and domestic or urban developments. Waste effluent from the City of Susanville is the only discharge in excess of 0.5 mgd. Serious impairment of the quality of the Susan River by waste discharges has not occurred nor been reported.

A water quality sampling station is maintained on Susan River at Susanville (17b) to monitor quality of runoff from the basin.

SUSAN RIVER AT SUSANVILLE (STA. 17b)

Sampling Point. Station 17b is located in Section 31 of Township 30 North, Range 12 East, Mt. Diablo Base and Meridian. Monthly grab samples were collected from the left bank, USGS gaging station, 0.5 mile west of Susanville, and 1.1 miles upstream from Piute Creek.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Past samples show water from Station 17b to be calcium-magnesium bicarbonate in character, class 1 for irrigation, varying from soft to slightly hard. Susan River water consistently meets drinking water requirements for mineral content.

Significant Water Quality Changes. None.

WATER QUALITY RANGES

Item	Maximum of Record	Minimum of Record	Maximum - 1961	Minimum - 1961
Specific conductance (micromhos at 25°C)	490	55.5	214	60
Temperature in °F	77	32	71	32
Dissolved oxygen in parts per million	12.5	6.6	11.8	6.7
Percent saturation	98	70	87	72
pH	8.4	6.8	8.4	7.1
Mineral constituents in parts per million				
Calcium (Ca)	20	5.7	20	9.6
Magnesium (Mg)	16	2.2	11	4.4
Sodium (Na)	8.4	1.5	7.7	1.8
Potassium (K)	4.5	0.3	2.5	0.7
Carbonate (CO_3)	3	0.0	3	0.0
Bicarbonate (HCO_3)	238	32	141	36
Sulfate (SO_4)	2.3	0.0	1.0	1.0
Chloride (Cl)	12	0.0	1.8	0.0
Nitrate (NO_3)	1.0	0.0	0.3	0.3
Fluoride (F)	0.2	0.0	0.1	0.1
Boron (B)	0.24	0.0	0.0	0.0
Silica (SiO_2)	42	16	41	28
Total dissolved solids in parts per million	370	42	162	45
Percent sodium	20	9	19	9
Hardness as $CaCO_3$ in parts per million				
Total	120	23	101	26
Noncarbonate	2	0.0	0.0	0.0
Turbidity	350	0.0	20	2
Coliform in most probable number per milliliter	7,000.	0.045 -	7,000.	0.045 -
Radioactivity in micro-micro curies par liter				
Dissolved alpha	0.32	0.00	0.03	0.00
Solid alpha	1.65	0.00	0.71	0.0
Dissolved beta	13.7	0.00	4.7	0.4
Solid beta	25.5	0.00	2.4	1.9

WATER QUALITY VARIATIONS

SUSAN RIVER AT SUSANVILLE (STA. NO. 17b)

Truckee River Basin

The Truckee River drains an area near the central portion of the Lahontan Region at the "elbow-bend" in the California-Nevada border. The California portion of the river basin is predominantly alpine with 621 of the 805 square miles classed as mountainous. The remaining 184 square miles are valley and mountain meadow land. The estimated mean annual runoff from the California portion of the basin is 581,000 acre-feet.

Lake Tahoe, formed by the down-dropping of a fault block along the Sierra Nevada fault, is one of the prominent physical features of the Truckee River Basin. With a mean water surface elevation of 6,228 feet and an approximate 120 miles of shore line, it has become an internationally known recreation and vacation attraction. Development is primarily associated with recreation. Lumbering is carried on to a minor degree in the basin.

Wastes discharged into the waterways of the area draining into the lake are limited in number and have been small in quantity; however, any potential increase has been viewed with trepidation as to the possible effect on this important body of water. A review of available data reveals that no significant impairment to the lake has been detected under present conditions.

The following tabulation presents the names of stations maintained to monitor quality of surface water in this basin and the page on which each is discussed.

Monitoring Station	Page Number of Station Discussion
Lake Tahoe at Bijou	410
Lake Tahoe at Tahoe Vista	412
Lake Tahoe at Tahoe City	414
Truckee River near Truckee	416
Truckee River near Farad	418

LAKE TAHOE AT BIJOU (STA. 39)

Sampling Point. Station 39 is located on the south end of Lake Tahoe in Section 33 of Township 13 North, Range 18 East, Mt. Diablo Base and Meridian. The monthly grab samples were collected from a pier near Connolly's Resort located in Bijou, El Dorado County.

Period of Record. April 1951 through December 1961.

Water Quality Characteristics. Past analyses show the water at Station 39 to be calcium bicarbonate in character, soft, and excellent for most beneficial uses. The quality is very similar to that reported at Tahoe Vista (STA. 37) and Tahoe City (STA. 38).

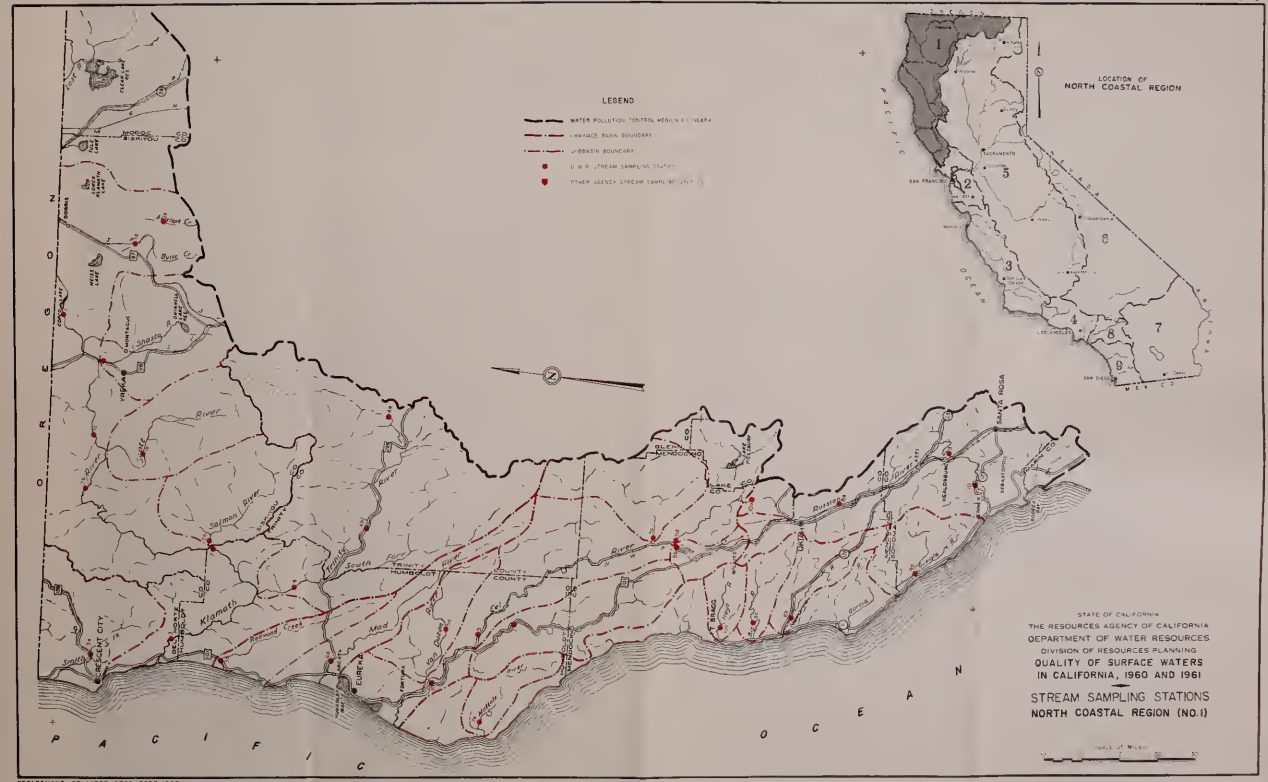
Significant Water Quality Changes. None.

STREAM SAMPLING STATIONS

NORTH COASTAL REGION (NO. 1)

Station Number	Station Name
1	Klamath River near Copco
1a	Shasta River near Yreka
1b	Scott River near Fort Jones
1c	Klamath River above Ramburg Reservoir Site
1d	Butte Creek near MacDoel
1e	Antelope Creek near Tennant
2	Klamath River at Somesbar
2a	Salmon River at Somesbar
2b	Klamath River near Seiad Valley
3	Klamath River near Klamath
3a	Smith River near Crescent City
3b	Redwood Creek at Orick
4	Trinity River near Hoopa
4a	Trinity River at Lewiston
4b	Trinity River near Burnt Ranch
5	Eel River near McCann
5a	Van Duzen River near Bridgeville
5b	Outlet Creek near Longvale
5c	Eel River, Middle Fork at Dos Rios
5d	Eel River near Dos Rios
6	Eel River at Scotia
6a	Mad River near Arcata
7	Eel River, South Fork near Miranda
7a	Mattole River near Petrolia
8a	Russian River near Hopland
8b	Navarro River near Navarro
8c	Big River near Mouth
9	Russian River near Healdsburg
9a	Gualala River, South Fork near Annapolis
10	Russian River at Guerneville
10a	Russian River, East Fork at Potter Valley Powerhouse
10c	Noyo River near Fort Bragg

PLATE 1

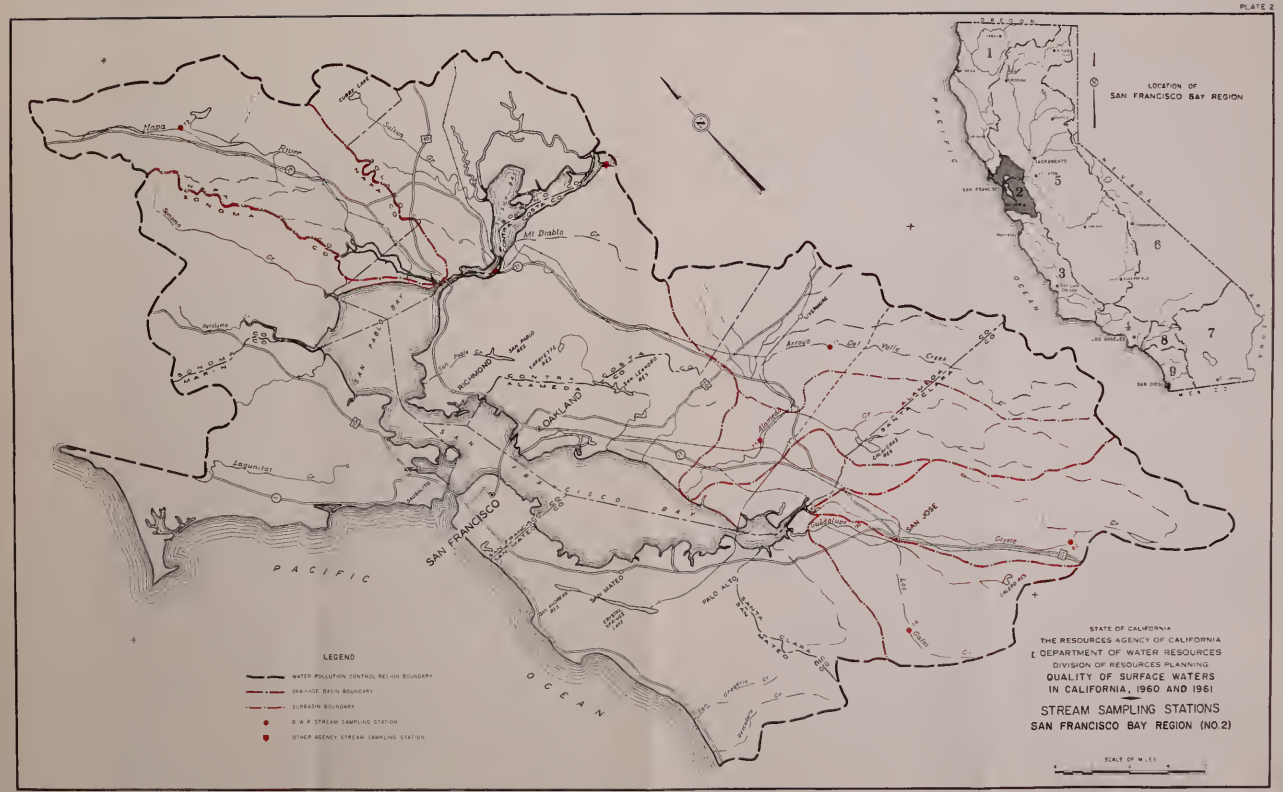


DEPARTMENT OF WATER RESOURCES 1963

STREAM SAMPLING STATIONS

SAN FRANCISCO BAY REGION (NO. 2)

Station Number	Station Name
15c	Sacramento River at Mallard Slough
28a	Carquinez Strait at Martinez
71	Arroyo del Valle at Veterans Administration Hospital
72	Napa River near Saint Relena
73	Alameda Creek near Nilea
74	Los Gatos Creek at Los Gatos
82	Coyote Creek near Madrone



STREAM SAMPLING STATIONS

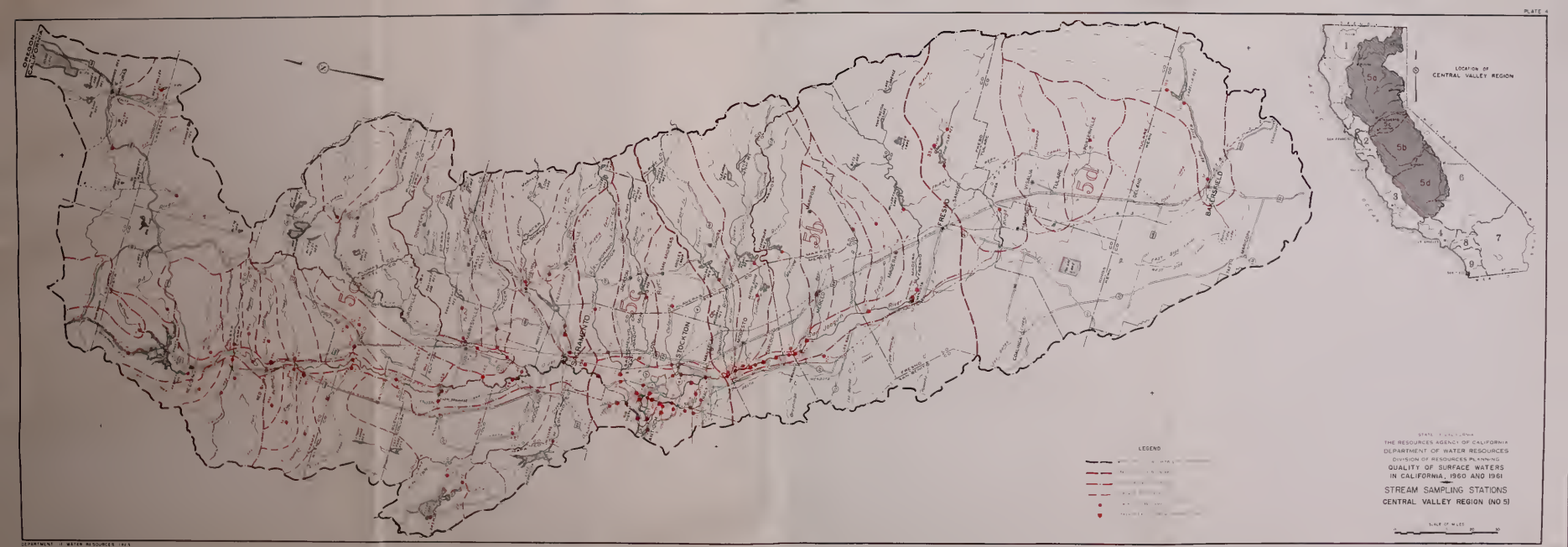
CENTRAL COASTAL REGION (NO. 3)

Station Number	Station Name
43	Salinas River near Spreckels
75	San Lorenzo River at Big Trees near Felton
76	Soquel Creek at Soquel
77	Pajaro River near Chittenden
77a	San Benito River near Bear Valley Fire Station
83	Carmel River at Robles del Rio
96	Uvas Creek near Morgan Hill

STREAM SAMPLING STATIONS

CENTRAL VALLEY REGION (NO. 5)

Station Number	Station Name
11	Sacramento River at Delta
11a	Cottonwood Creek below North Fork Cottonwood Creek
11b	Cottonwood Creek, South Fork above Cottonwood Creek
12	Sacramento River at Keswick
12b	Cottonwood Creek near Cottonwood
12c	Sacramento River at Bend
12d	Clear Creek near Igo
13	Sacramento River near Hamilton City
13a	Stony Creek near Hamilton City
13b	Sacramento River at Colusa
13c	Stony Creek at Black Butte Dam Site
13d	Thomes Creek at Paskenta
13e	Elder Creek near Paskenta
14	Sacramento River at Knights Landing
14a	Sacramento Slough near Knights Landing
14b	Sacramento River at Freeport
14c	Sacramento River at Boyers Bend
15	Sacramento River at Sacramento
15a	Sacramento River at Toland Landing
15d	Sacramento River at Freeport
16	Sacramento River at Rio Vista
16a	Calaveras River at Jenny Lind
16b	Calaveras River near Stockton
17	Pit River near Montgomery Creek
17a	Pit River near Canby
17d	Indian Creek near Crescent Mills
17e	Pit River near Bieber
18	McCloud River above Shasta Lake
18a	Pit River, South Fork near Likely
19	Feather River near Oroville
20	Feather River at Nicolaus
20a	Feather River below Shanghai Bend
20b	Bear River near Mouth
21	Yuba River Marysville
21a	Yuba River near Smartville
22	American River at Sacramento
22a	American River at Nimbus Dam
22b	American River, Middle Fork near Auburn
22c	American River, South Fork near Lotus
22d	American River at Fair Oaks
23	Mokelumne River at Woodbridge
23a	Mokelumne River near Lancha Plana
23b	Mokelumne River below Cosumnes River
23c	Mokelumne River below Georgiana Slough
24	San Joaquin River at Friant
24b	San Joaquin River at Whitehouse
25	San Joaquin River near Mendota
25a	San Joaquin River near Dos Palos
25b	San Joaquin River at Hills Ferry Bridge
25c	San Joaquin River at Fremont Ford Bridge
26	San Joaquin River near Grayson
26a	San Joaquin River at Maze Road Bridge
26b	San Joaquin River at Crows Landing Bridge
27	San Joaquin River near Vernalis
27a	San Joaquin River at Patterson Water Company
27b	San Joaquin River at West Stanislaus Irrigation District Intake
28	San Joaquin River at Antioch
28b	San Joaquin River at Jersey Point
29	Stanislaus River near Mouth
29a	Stanislaus River below Tulloch Dam
30	Tuolumne River at Hickman-Waterford Bridge
30a	San Joaquin River above Merced River
31	Tuolumne River at Tuolumne City
31a	Tuolumne River below Don Pedro Dam
32	Merced River near Stevinson
32a	Merced River below Exchequer Dam
33b	Kings River below Pine Flat Dam
33c	Kings River below North Fork
33d	Big Creek above Pine Flat Dam
34	Kings River below Peoples Weir
35	Kaweah River near Three Rivers
36	Kern River near Bakersfield
36a	Kern River below Isabella Dam
36b	Kern River near Kernville
41	Clear Lake at Lakeport
42	Cache Creek near Lower Lake
78	Bear River near Wheatland
79	Cache Creek, North Fork near Lower Lake
80	Cache Creek near Capay
81	Putah Creek near Winters
84	Butte Creek near Chico
85	Big Chico Creek near Chico
85a	Big Chico Creek at Chico
87	Colusa Trough near Colusa
87a	Sacramento River at Butte City
88	Mill Creek near Los Molinos
88a	Cow Creek near Milville
88b	Battle Creek near Cottonwood
88c	Antelope Creek near Mouth
88d	Redbank Creek near Red Bluff
88e	Antelope Creek near Red Bluff
88g	Paynes Creek near Red Bluff
91	Tule River near Porterville
92	Delta-Mendota Canal near Mendota
92a	Salt Slough at San Luis Ranch
93	Delta-Mendota Canal near Tracy
94	Cosumnes River at Michigan Bar
94a	Cosumnes River at McConnell
95a	Elder Creek at Gerber
95b	Thomes Creek near Mouth
97	Sacramento River at Snodgrass Slough
98	Delta Cross Channel near Walnut Grove
99	Little Potato Slough at Terminous
100	Stockton Ship Channel on Rindge Island
101	San Joaquin River at Garwood Bridge
101a	San Joaquin River at Brandt Bridge
102	San Joaquin River at Mossdale Bridge
103	Old River near Tracy
103a	Grant Line Canal at Tracy Road Bridge
104	Old River at Clifton Court Ferry
106	Italian Slough near Mouth
107	Indian Slough near Brentwood
108	Old River at Orwood Bridge
108a	Old River at Holland Tract
108b	Dutch Slough at Farrar Park Bridge
109	Rock Slough near Knightsen
109a	Contra Costa Canal at First Pump Lift
110	Lindsey Slough near Rio Vista
110a	Cache Slough below Lindsey Slough
111a	Bear Creek at Merced
111b	San Joaquin River above Salt Slough
112	Old River at Mandeville Island
112a	False River at Webb Tract
112b	San Joaquin River at San Andreas Landing
113	Fresno River near Daulton
114	Chowchilla River at Buchanan Dam Site


5a
5b
5c
5d
SACRAMENTO
STOCKTON
FRESNO
BAKERSFIELD
LEGEND
LOCATION OF CENTRAL VALLEY REGION
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
QUALITY OF SURFACE WATERS IN CALIFORNIA, 1960 AND 1961
STREAM SAMPLING STATIONS
CENTRAL VALLEY REGION (NO 5)
SCALE OF MILES

STREAM SAMPLING STATIONS

LAHONTAN REGION (NO. 6)

Station Number	Station Name
17b	Susan River at Susanville
37	Lake Tahoe at Tahoe Vista
38	Lake Tahoe at Tahoe City
39	Lake Tahoe at Bijou
52	Truckee River near Truckee
53	Truckee River near Farad
115	Carson River, East Fork near Markleeville
115a	Carson River, West Fork at Woodfords
116	Walker River, West near Coleville
116a	Walker River, East near Bridgeport

ANNEX